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# ENGINEERING & MINING JOURNAL-PRESS

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By David Cole

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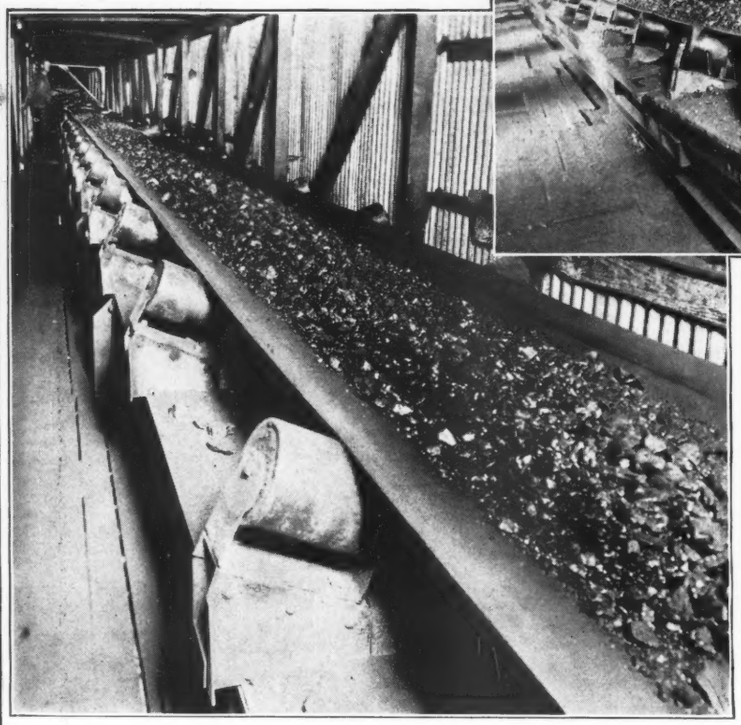
By A. J. McDermid

El Cerro Rico de Potosí, Peru, where silver was discovered in 1545.


A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

September 23, 1922

*S-A Unit Carriers in re-screening plant of Orient No. 1 Mine of C. W. & F. Coal Co., Orient, Ill.*



*S-A Unit Carriers in tipple of Zeigler No. 1 Mine of Bell & Zoller Mining Co., Zeigler, Ill.*

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## Our Manganese Reserves

THE ESTABLISHING of a tariff on manganese ore was the result of the earnest campaign waged by the American Mining Congress. Its researches and inquiries led to the compilation of data showing a large available tonnage of high-grade as well as low-grade manganese ores (manganiferous iron ores), and it was the presentation of the results of this investigation which undoubtedly decided Congress in favor of the tariff, in spite of the fact that the established Executive bureaus of the government in Washington did not and do not agree with these estimates of manganese reserves. The U. S. Geological Survey is the best-recognized authority on these subjects, having specialized for years in the statistics of mineral production—with which business it is charged by Congress and an annual appropriation voted for the purpose; and being equipped, from its familiarity with geological principles, for the safest and most approximately correct estimate of ore in the ground. The estimates of available reserves of high-grade manganese in the United States by the U. S. Geological Survey and by the American Mining Congress are as far apart as the poles, though all agree that the reserves of manganiferous iron ores are very large.

Congress may be likened to an investor who receives two reports on the ore reserves of a mining property concerning which he is seeking the truth. In this case they do not check. The way of the investor would have been to have called for a check in the way of a third report, and this is what Congress should have done; but Congress is far more careless with its laws than the investor is with his ventures. As a makeshift instead of a check, if Congress could not judge between the reliability of the writers of the differing reports, an average between the two might have served as a rough basis for discussion. It is not unlikely that as a matter of fact the truth may be found between the two glaringly different estimates. The difficulty of estimating ore reserves is known to the experienced engineer; and the very exceeding difficulty of estimating ore not yet developed. Ore as mined is apt to exceed the predictions of the conservative engineer and adviser to investors, although far less than the hopes of sanguine promoters. In the present case we have what we may describe as an engineer's report on the one hand, and a seller's report on the other. Conservative and too cautious as the average engineer's report is apt to be (and has not this fact been sufficiently bruited in our discussion columns and elsewhere to be patent?), it is also true, though not so loudly advertised, that a seller's report is rarely reliable. Out of several thousand checked up by a certain examining engineer corps, two (not two thousand) were found to be absolutely accurate.

It still remains a most important thing to discover what the best estimate is for American manganese reserves. A wise future governmental and private policy as regards manganese mining depends on having this fundamental basis for calculation as accurate as possible. So far, evidently, with the wide divergence of opinion, we have nothing we can tie to. We should know the methods and resources of the U. S. Geological Survey inquiry; we should inquire into the basis on which the American Mining Congress conclusion has been reached. The official report of the basis for this conclusion is couched in language that is not wholly assuring:

"I have before me two hundred or more statements of state geologists, mine operators, and mining engineers of recognized authority; statements signed by mine operators and owners; some of them are sworn to, many of them are based on careful engineers' reports, from which are summarized the manganese reserves of the United States."

If the investor, for whom the several thousand reports on mining properties above mentioned were checked up, had accepted the sworn statement of the owners as to their ore reserves, the amount that he would have sunk in investment would have been of the same degree of magnitude as the amount of the German reparation. Any appraiser of mines knows that the examination must be conducted by a disinterested party.

## Competition Increasing in the Nickel Industry

BEFORE THE GREAT WAR, practically all of the nickel sold in the United States was produced by the International Nickel Co. from ores mined and smelted in Ontario. The converter matte was refined at Bayonne, N. J., and the nickel and Monel metal there produced were fabricated by independent concerns. A comparatively insignificant amount was produced by the U. S. Nickel Co. at New Brunswick, N. J., from foreign ores and mattes, by copper smelters as a byproduct, and by a company operating on cobalt-nickel ore in Missouri. Today, however, three companies are actively competing for business in this country, and two fabricating plants are under the control of producers or in close affiliation with them.

The International Nickel Co. is still the principal interest, both in this country and the world. All of the refining is now done at the new plant at Port Colborne, Ont., where costs are presumably sufficiently low to offset the proposed customs duty of 3c. per lb. on metallic nickel, which would not have to be paid had the refining been continued in this country. A completely equipped rolling mill has been built and recently put in service at Huntington, W. Va., so that the producer can control this end of the business and develop it properly.

The second most important producer of the world, the Mond Nickel Co., which has its mines and smelter near those of the International company in Ontario, formerly sold all of its product abroad, and paid no attention to

the American market, though it met competition from the International company in Europe. Last year, however, Lewis Lazarus & Sons were appointed American sales agents for Mond nickel. In the last few months this outlet has been superseded by arrangements with a fabrication plant in Pennsylvania and direct sales through that agency. This is known as the American Nickel Corporation, which has taken over the rolling mill of the Nickel Alloys Co., at Hyde, Clearfield County, Pa. The directors of the American Nickel Corporation are C. V. Corless, general manager of the Mond Nickel Co., Ltd., Coniston, Ont.; Oliver Hall, Coniston, Ont.; Grant Shipley, Pittsburgh; G. P. Bassett, Pittsburgh; George Calvert, Pittsburgh; W. L. Dethloff, Clearfield, Pa.; and Dr. C. T. Hennig, of Clearfield. Mr. Basset is president, Dr. Hennig, vice-president, and T. J. Patton, secretary and treasurer. The general sales offices of the company are at 740-746 Oliver Building, Pittsburgh. Dr. Hennig is the inventor of a process of rolling and forging pure nickel which is expected to have wide application. The original company at Clearfield was formed to exploit his inventions.

The third interest now in competition for the American market is the British America Nickel Corporation, also with mines and reduction works in the Sudbury district of Ontario. This company was organized during the Great War, with British Government backing. Conditions have not been so favorable for its success owing to its having a lower grade of ore and to the lack of cheap hydro-electric power which the other two companies possess. It has the advantage of modern and exceedingly well-ordered plants, however. Although it has not been producing for the last year or two, this company has a large stock of nickel on hand which it is trying to dispose of through its New York office in the C. P. R. Building, managed by L. J. Buck. Quite recently operations at the refinery at Deschenes, Que., are reported to have been resumed on a small scale.

Competition in the nickel industry therefore promises to be active. The large amount of the metal formerly used in armament, which has been estimated at something like 40 per cent of the world's production, will, in a large measure, have to find another outlet unless present peace plans miscarry. Producers are actively engaged in the popular pastime of the non-ferrous metal industry—finding new uses for the metal and extending the popularity of present ones.

The course of prices will be interesting. Formerly, with the International company in sole control, the price was practically fixed at a figure which would net that producer a satisfactory profit. This was from 35 to 40c. per lb., and most of the metal was sold on long-term contracts. Undue advantage was not taken of the phenomenal war demand and the price was advanced only a few cents. The advantages of a fixed price are obvious; if it is a fair one they inure not only to the seller but to the buyer as well. Recently, competition from the two new sellers has brought the so-called outside market price down from the 36c. level of the International company to as low as 29c., though improved demand has now carried it up to about 33c. It would seem that one of two things must happen: either the International company must stick to its old price level and divide the market with its two smaller competitors; or, it must cut the price to such an extent that it will not pay one or both of the other producers to operate. There is little doubt that so long as the phenomenally rich Creighton orebody holds out, the International can sell nickel in this country cheaper than either of its competitors and still make a profit. A middle policy may be decided on: assuming that the British America company is the highest-cost producer of the three, it may be considered wise to establish the price at a figure just below that at which the British America company can operate. This would eliminate that competition, and would still assure a moderate profit, but would allow the Mond company to sell, in this country, its surplus over European demands, which normally would not amount to much.

The demand for nickel may, of course, become so great that all of the producers can run at somewhere near capacity, but there are no indications just now that this happy condition will obtain for some time.

## The Institute Meeting at San Francisco Has Attractive Features

AMONG the features of the forthcoming meeting of the Institute at San Francisco on September 25 and following days will be an excursion to the Comstock. Eastern members on their way to the Coast will be met at Reno by a delegation of Californians, who will accompany them to Gold Hill, where Bulkeley Wells and his associates of the United Comstock Mines Co. will entertain them mentally and physically. The mine is a consolidation of a number of famous old properties on the Comstock lode, whereas the mill exemplifies the latest ideas on the treatment of complex gold-silver ores. Another interesting excursion will be to the Carson Hill group of mines, on the Mother Lode, in Calaveras County. W. J. Loring has offered to be host to a party of nine engineers on a visit to these mines, of which he is manager. This should prove an interesting and attractive trip, particularly for those who are engaged in gold mining elsewhere. Of the other excursion, to the Hetch Hetchy water-works and tunnel, we have spoken in an earlier issue. This will be restricted to fifty visiting members. Among other points of interest in the vicinity of San Francisco are the Selby silver-lead smelter and the two universities. Golf will be provided for those devoted to the royal and ancient game. It is hoped that a representative contingent from east of the Mississippi will take part in the meeting. The dearth of Western members at many of the New York meetings has often been apparent, but no doubt many Eastern members can combine a vacation trip with the present San Francisco gathering.

## The Kirkland Lake Gold District of Ontario

NOT LONG AGO the Maryland Casualty Co, of Baltimore, addressed a letter to the Lake Shore Mines as follows: "The Lake Shore Mines, on the T. & N. O. Ry., between Cobalt and Timmins, Northern Ontario, Canada." Now, the Lake Shore mine and the Kirkland Lake district both deserve to be better known than that, and we venture to say that in a few years there will be few mining men at least who will not know quite a bit about that part of the world.

To those who want a vacation in and around the woods and lakes and who do not object to spending it in a country richly dotted with promising mining prospects, and where they can exercise such geological cunning as they may have, we recommend the Kirkland Lake district. Leaving Toronto just before nine in

the evening in a comfortable sleeper of the Canadian Government railway, one alights at Swastika about half-past three the next afternoon. A stop of two or three hours is made at North Bay for breakfast, an interval of time entirely disproportionate to the dining facilities provided in that town. From there, the traveler may enjoy an observation car attached to the transcontinental train. This government train is becoming very popular. The people are beginning to realize that the better the train is patronized the less the deficit, later to be met by taxes, will be. As a result, ten- and twelve-car trains over the northern route are now common, and the service is good. On the long transcontinental trip, occasional delays must be expected.

Swastika is the railroad point from which entry is made to the Kirkland Lake and Fort Metachewan gold districts. Several automobiles meet the train, the bus service operated by Walter Little being popular with the old-timers. The run out to the mining town is accomplished in about twenty minutes provided the automobile does not run into the tailing pond of the Lake Shore mine, as it did in the recent trip of one of the editors of the *Journal-Press*. The pond is on either side of, and on a level with, the road, and our editor had visions of a slimy end until the car was safely withdrawn by a team of horses. The road, as a whole, is good. A year or two ago communication was bad, and there was considerable discussion as to whether a narrow-gage railway or an automobile road should be built. The last-named plan was adopted after some questionable dealings in townsites along the proposed light railway.

Kirkland Lake is a picturesque town on the lake shore, largely composed of "shacks" evidently hurriedly constructed. The Kirkland Lake Hotel is a recently provided convenience, even if in no sense a luxury. The city visitor is not apt to select Miller's restaurant, from its exterior, as the best place in town in which to eat, but the meals are acceptable. The school building seems adequate, and Harry Oakes has provided an athletic field for the numerous baseball and association football games. In providing an attractive setting Nature has done her part well. Lakes are numerous, which, with their wooded shores, are equally attractive as most summer resorts. In July, the roadside abounds with raspberries, strawberries, and huckleberries. To make the picture complete we must not forget the wild life—especially the mosquitos and black flies, which are at their best—or worst—early in the summer.

The operating gold mines, all with mills, are five in number, and are situated in almost a straight line along a fault zone locally termed "the break." First comes the Kirkland Lake, then the Teck-Hughes, the Lake Shore, the Wright-Hargreaves, and lastly the Tough-Oakes, now refinanced by English capital and known as the Kirkland Lake Proprietary. The gold occurs largely native, with some tellurides, and the country rock includes conglomerate, syenite, porphyry, and lamprophyre, most of the vein ore having a characteristic reddish color due to the included porphyry. The veins are in general well defined, with widths and values which vary greatly. They are not so numerous as in the Porcupine district, but have been highly profitable in many instances.

The Kirkland Lake mine, to the west, is owned by the Beaver interests, of Cobalt, and is the deepest mine of the district, being down about 1,000 ft. The next property, the Teck-Hughes, suffered in the early days from various man-made causes, but with the present excellent management promises soon to pay dividends. It is reported that the main oreshoot dips into the Orr property adjoining on the south at about 1,200 ft.; if this is a fact, it is to be hoped that a mutually satisfactory arrangement can be made for working the combined properties without a duplication of effort. Confidence in the success of the Teck-Hughes has brought the stock up from 45c. to practically its par value, $1, in three months.

The Lake Shore has the smallest mill of the five, with a capacity for only about seventy-five tons, but the property is one of the richest in the camp. Practically nothing but development ore has been milled, but the grade as taken out of the drifts has averaged around $25 per ton, and dividends have been paid for some time. It is understood that provision is soon to be made for a larger mill.

The next property, the Wright-Hargreaves, is generally considered to be the cream of the district. The property embraces more of the main ore zone than does the Lake Shore, and a model 200-ton mill has been built. The company is closely controlled as to stock ownership.

The Tough-Oakes has suffered from litigation, but seems now in a fair way to make some money. Phenomenally rich ore was found on the surface, and the property is showing up well at depth. As the Kirkland Lake Proprietary, the Tough-Oakes is now merged with the Burnside, and an interest in the neighboring Sylvanite is secured.

The problems of the district are essentially concerned with mining rather than with milling. After the ore is taken from the ground there is little difficulty in extracting the gold. The flow sheets of the various mills have been published by the Ontario Department of Mines in a bulletin issued last year. The general practice is to crush in a jaw or gyratory crusher, followed by grinding in ball and tube mills, and counter-current decantation, using zinc dust for precipitation. Zinc boxes are not used at any of the northern Ontario gold mines.

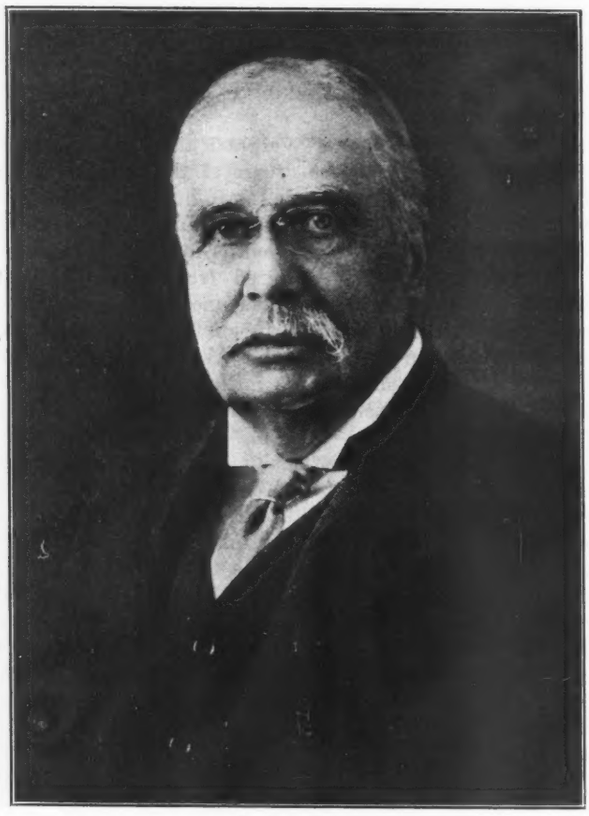
The surrounding country has many promising prospects, the vein systems not being directly connected with those of the properties just mentioned. The Argonaut, about twelve miles to the east, is building a mill, and, with the trustworthy management which it has, should develop into a producer. Less far along in development are the Bidgood and King Kirkland mines, but the surface work is decidedly promising. The Montreal-Ontario has a mill, but so far no ore. To the north from Kirkland Lake is the Goodfish Lake mine, and its neighbor, the Providence, both well spoken of. Hundreds of other claims have been staked in the last year or two, many with good surface showings, and on many of which work is being actively carried on.

Kirkland Lake is not a boom camp filled with wildcats. The visitor is impressed with the apparent honesty with which money is being spent, and with the conservative optimism of the men one meets, about the district. The brokers have not been allowed to get the upper hand, though money is badly needed. It is not likely that there will ever be any Hollingers in the district. The present mines are small ones, but are profitable, and there is as yet nothing to indicate that they will not have a long life. As we intimated at the outset, the district is attractive for the engineer wishing to look over new discoveries of promise in an attractive and accessible region.

# Gardner F. Williams

## An Appreciation, by T. A. Rickard

GARDNER WILLIAMS died in San Francisco on August 22. It was known to his friends for more than a year that his days were numbered but the news of the end came as a shock nevertheless. Death will have its sting as long as man is mortal. Gardner Williams, moreover, was a man who enjoyed life and made the most of it, through all his 80 years. He was born at Saginaw, Michigan, in 1842. His father, Alpheus Williams, was engaged in the lumber business



*Gardner F. Williams*

and built the first saw-mill at Saginaw; he was of the pioneer type, like the grandfather, who was one of the first settlers of Detroit, going thither from Boston in 1815. Alpheus Williams came to California in 1851 and seven years later he returned to Michigan to fetch the family. Gardner was then a boy of 15. He had received a fairly good schooling at Pontiac, Michigan, and was preparing to go to the University at Ann Arbor when he was transplanted to the Pacific Coast. Soon after arrival here, in October 1858, he entered the College School at Oakland. This was the precursor of the College of California, which became the University of California. He was graduated from the State university in 1865, and for many years he had the honor of being its oldest living graduate. In 1910 he received the honorary degree of Doctor of Laws from the University of California.

Ten days after graduation he went to Freiberg, in Saxony, where he was a student at the famous Mining Academy for three years. On his return, in 1869, he examined the salt deposits of Carmen island, in the Gulf of California, and in 1870 he was appointed an assayer at the Mint in San Francisco. This appointment he resigned after a year to go to Pioche, Nevada, where he was engaged as assayer and mill superintendent for the Meadow Valley Company. He remained there for 3½ years. In 1871 many of the miners of Pioche went to South Africa, enticed by the stories of diamond discoveries at Kimberley. Little did he think then how prominently he was to become identified with the diamond industry of South Africa. From Pioche he went to Silver Reef, in Utah. That was in 1875. When the mine 'petered out' he returned to California, before going to White Pine, Nevada, where again he had charge of a silver mine. In 1880 he became a mining expert for a New York exploration company and traveled widely in the West and South-West. Among other experiences it is necessary to mention his connection with the hydraulic mines at Dutch Flat and his later management of the Spring Valley, which was the biggest hydraulic mine in California. Through this work he became acquainted professionally with E. G. De Crano, whom he had known previously as a fellow student at Freiberg. In 1884 De Crano, the partner of Hamilton Smith, who was consulting engineer to the Exploration Company of London, in which the Rothschilds were largely interested, was asked to recommend an engineer familiar with gold mining, both vein-mining and hydraulicking. De Crano recommended Gardner Williams, whereupon he received a telegram to come to London, in April 1884. He was sent to take charge of a gold mine at Pilgrim's Rest in the Transvaal. The venture proved to be only a prospect, so he returned to California in 1885. Again he received a call from Smith & De Crano, this time to join them as a member of the staff of the Exploration Company. Again he went to South Africa. In 1887 on a voyage from Cape Town to London, he made the acquaintance of Cecil Rhodes, who later asked him to take charge of the De Beers diamond mines at Kimberley. He obtained a release from the Exploration Company and on May 1, 1887, he became manager for the De Beers Mining Company, which was the predecessor of the De Beers Consolidated Mines Ltd. He held this highly responsible and most important position for 18 years, until he resigned in favor of his son, Alpheus, in 1905.

During his management of the old De Beers mine it became the nucleus of a big consolidation made by Cecil Rhodes—a consolidation so comprehensive that it controlled the diamond market of the world. At one time 90 per cent of the South African diamond output came from the De Beers group of mines. During his management the primitive and dangerous system of open-pit mining was abandoned in favor of shaft-sinking and systematic underground exploitation of the big chimney-like deposit of blue ground in which the diamonds are found. The Kimberley mine is now 3,520 ft. deep, although the stopes do not extend below 2,500 ft. Here I may state that the diamantiferous deposit is a volcanic vent of crater-like shape that in its vertical extension traverses a nearly horizontal series of sedimentary rocks (shale, conglomerate, and quartzite) overlying a quartz-porphyry. The huge 'pipes' or 'chimneys' are occupied by the diamantiferous 'blue ground', which is a breccia, of various constituents, including fragments of the enclosing rocks; it has been described by Stelzner as "a porphyritic volcanic peridotite of basaltic structure". These notes I obtain from the book on 'The Diamond Mines of South Africa' pre-

pared and compiled by Gardner Williams, with the literary assistance of Eliot Lord, author of one of the Comstock monographs. This work, published in 1902, in two handsome volumes, will remain an enduring monument to the manager of the De Beers and to the generosity of his directors, who contributed £10,000 of the company's funds to the publishing of it. Thanks also to the generosity of its author, the book has been widely distributed among colleges and libraries. It is a most interesting history of a great mining enterprise. In 1905 Gardner Williams resigned his managership and returned to the United States. He bought a mansion at Washington and lived there until 1914, when his failing health caused him to come to San Francisco to visit his youngest daughter, Mrs. Eyre Pinckard. While here he renewed acquaintance with many of the friends of his youth.

In looking back over the career of this distinguished American engineer, I note that his choice of a profession was due to an early familiarity with mining. His father and uncles owned and operated mines and ditches in Yuba, Butte, Nevada, and Sierra counties, in California. While he was a boy his parents lived at Butte, in Sierra county, so that he was near mines, to which he went often. His father put the first water into Oroville in 1854. His opportunity to go to South Africa, where he became famous, as we have seen, was due, in the first place, to his friendship with De Crano, whom he met at Freiberg, but it was due also to his experience in gold mining in California, especially in hydraulicking. The mine in the Transvaal to which he was sent was supposed to be somewhat similar to the Spring Valley. It proved to be otherwise, but I have no doubt that the handling of large blocks of alluvial ground in California prepared him for the task of opening up the diamond deposits in South Africa. When he looked at the huge open-cut at Kimberley in 1888 he must have thought at once that the drift-mining method, by which a goldbearing alluvial channel is opened up through underground workings, would suit the conditions. An old friend of Gardner Williams tells me that when he returned from South Africa on his second trip he talked freely, in the smoking-room, about the foolishness of mining for diamonds in the way they were doing at Kimberley, and, when asked for an alternative method, he suggested the sinking of vertical shafts and the extending of levels, as parts of the caving system. He asserted confidently that it would save lots of money; it was the way in which the 'deep leads' were worked in California. On his arrival in London, just before sailing for New York, he received a letter from a fellow passenger that had heard his talk. This man happened to be a director of one of the big mining companies; he asked him to come to the City and meet the board of directors, so that he might explain his idea of how the Kimberley mine should be worked. As a result of the meeting, he was engaged as general manager. There are some elements of probability in this story. Gardner Williams was ever a sociable and talkative man. He would be likely to talk freely on such a subject to a congenial companion on board ship. Whether the "director" was Cecil Rhodes himself or an associate of the empire-builder, I do not know. The facts I give concerning his first meeting with Rhodes and the circumstances leading to his going to South Africa I obtained from Gardner Williams himself four years ago.

In 1872 he married Miss Fanny Martin Locke of Oakland; he lost his wife tragically when she was drowned in the shipwreck of the 'Spokane' on June 29, 1911. He leaves a son Alpheus, who is now manager at Kimberley, and three daughters, one of whom, Frances, is the wife of William W. Mein.

Gardner Williams had a character that endeared him to his associates and employees. He was rugged and straightforward in his dealings. In his prime he was strong-willed and insistent, tenacious of purpose, and energetic in overcoming obstacles. These characteristics were developed by his experience as an executive in big mining operations. He was kindly and sagacious. Those who worked with him say that he was loyal and honest, as well as able and aggressive. If ever an injustice resulted from one of his decisions the 'Old Boss', as he was called affectionately, would feel it keenly and would hasten to make amends. He was no respecter of red tape; he maintained a close personal contact with the details of his business and with the personnel of his staff. He backed his subordinates cordially and was as ready to give them the credit they deserved as he was to accept his share of the responsibility for a mistake they might make. He had the happy gift of making men feel that he had an interest in their personal affairs as well as in their technical work. This trait is exemplified by his habit of offering a lift to any member of his staff that he might encounter when he happened to be driving near the mines, and then chatting with him about his work. His friend Henry C. Perkins has always insisted that Gardner Williams managed the De Beers in the interest of the shareholders; he did not speculate in the shares, nor did he take advantage of his knowledge of the diamond market; he conducted operations for the benefit of the shareholders and for the welfare of the community at Kimberley. In this policy he had the support of Cecil Rhodes; between them they prevented any purely selfish motive becoming so dominant as to cause the diamond syndicate to become grasping and greedy in its virtual control of a monopoly. Although a graduate of two colleges, he was not of the academic type, being inclined to action rather than theory. In his private life he loved a bit of fun and gave free vent to his good nature; he was an affectionate father and a sympathetic friend. Gardner Williams was a successful engineer and a famous administrator, a companionable gentleman and a broad-minded citizen; his memory will live in the hearts of his friends and in the record of his achievements.

## Ancient Miners of Arizona Treated Low-Grade Ores

At a number of points in southwestern Arizona have been found the remains of rude adobe furnaces at which Spaniards or Mexicans smelted silver-lead ores from mines considered by the later American miners of no very large value. These old mines seem to have been unchronicled in the annals of Sonora and were far north of the ordinary range of Spanish activities. One such mine and smelter is near Quartzsite. It was bought lately by D. W. Hall, who has found much ore worth shipment. In this same locality, thirty years ago, a prospector brought to the Colorado River a bar of smelted silver, a veritable "plancha de plata," a foot wide, 18 in. long and 2 in. thick and weighing about 100 lb. He sold it to the Hodges brothers, of Yuma, whom he told that he had found the bar where it had been partly buried in dirt, possibly after its bearers had been slain by Indians.

# DISCUSSION

## Hiring and Firing

THE EDITOR:

Sir—It has long been recognized that time of service should be considered and is entitled to some reward. Recently this has attracted attention in connection with the seniority rights of the railway employees. One method of establishing these rights was presented in an editorial entitled "Seniority" in the *Engineering and Mining Journal-Press* of Aug. 19. There are many customs and regulations, varying with the nature of the employment, local conditions, and views of the management and employees, and it is not worth while to here discuss all these. The one great question is, Is it right and how much consideration should we give to the question of time of service?

It may help to clear our ideas if we go one step deeper and first take up the question of the power to discharge. Many have taken the view that the power to discharge should not rest with the management, but should only be applied on proven charges before some board on whom the decision would rest. This is on the theory that an injustice may be done to the worker. While this, apparently, has some foundation, we certainly cannot expect managers to be responsible if they do not have the selection of their assistants. A few illustrations may help to make this clear. In executive positions we certainly recognize that the head must have the power of appointing his immediate assistant, and assistants in turn must have the power of appointing their helpers. The power to appoint necessarily implies the power to discharge. We certainly cannot hold the head responsible if he cannot get loyal and good support from his subordinates. This is apparent in the case of the surgeon, who must have assistants that suit his ideas. In the case of the cook, the food must be prepared to suit the ideas of those that are to eat it, and not to suit even better experts on cooking. The same thing applies to the care and operation of machinery, or, in fact, any operations. The plea that often an injustice is done to an employee cannot be remedied by taking away the responsibility of the management. This plea of injustice is very much exaggerated. While no doubt it sometimes happens, the general experience of operators shows that their employees are made up of valuable workers who grade off until we always have many that properly should be discharged. No industry has a crew of 100 per cent efficiency, and there is always quite a percentage which should properly be discharged, but are retained only because of the expense and difficulty of finding better men. No doubt many more are improperly retained than the few who are unjustly discharged. An operator who improperly discharges will soon have a small indifferent crew.

Conceding the power to discharge, we find that the reward for time of service is very closely linked with the power to discharge. It is not alone time of service that makes a man valuable, and we would certainly many times prefer one with a limited time over one that had been in long service. It may very readily happen that, of two of equal time of service, one should properly be discharged and a milder form of discipline would be retarding his advancement. Some have tried to get over this difficulty by inserting "when competent." This hardly covers the case, for of two men equally competent one may be much more valuable for the position than the other.

We are always confronted with trouble when we attempt to make rules for human problems. They cannot be expressed mathematically, and language is hardly broad enough to express in one short rule the whole question. We note this in our criminal law, where for the same expressed crime the punishment varies considerably, so that the court may have great latitude in its verdict. The commandment "Thou shalt not kill" cannot be taken literally, for we have all kinds of taking of human life, varying to the widest extremes.

If we attempt to make rules we almost inevitably destroy interest and ambition, for if the individual is held back by a rule regarding the time of service there is no incentive for special effort. We tend to level down and not bring up the general standard. It is hopeless to expect absolute justice in all cases, for we are all human, and, naturally, errors will certainly occur. Honesty and justice are the only foundations to build on, and looking back we can see that we have made great progress, but have a long way to go before satisfactory results can be obtained. ARTHUR THACHER.

St. Louis.

## The Mining Congress and the Tariff

THE EDITOR:

Sir—As you know, I am an operator of several gold properties and have been connected with this particular side of mining for a number of years and also have been for several years a director of the American Mining Congress and in such position have been in very close touch with the program of that organization affecting the gold industry. I have made it my business during the last two years, while acting as president of the American Mining Congress, to keep in very close touch with its policy, and I wish to correct such statements as the one implied in the *Engineering and Mining Journal-Press* under date of July 22, 1922, which I quote as follows:

"Therefore, we emphatically disapprove of the Mining Congress campaign for a high tariff on everything, even on cyanide, in order to be consistent; for we foresee, with Senator Edge, only disaster to mining resulting from this universally applied principle."

The above does not express the stand that the American Mining Congress has taken in the past, to my certain knowledge. As a matter of fact, I personally had some discussion upon this very subject, which is fresh in my mind, and I am, therefore, in a position to know exactly what the stand of the American Mining Con-

gress has been with reference to certain tariff measures, and it is not in accordance with the statement quoted above.

At its annual conventions the American Mining Congress has indorsed such tariff schedules as it supported, which was the only reasonable thing to do, but at no time has it so indorsed a tariff on cyanide, and it was this particular measure that caused the discussion between myself and the American Mining Congress, which is, as stated above, fresh in my mind, and at no time has it supported before any Congressional committee such a tariff, and to my certain knowledge it has at all times supported the needs of the gold industry, and its stand on the cyanide tariff has been in support of the requirements of the gold industry and, of course, not in support of a tariff on cyanide, as stated above.

I wish to call your attention to the fact that the statement quoted above, which your journal published, is, of course, entirely contrary to the facts as I know them, and I am very sorry that such an impression should have been given through the *Engineering and Mining Journal-Press*, and I hope that this statement will correct the erroneous impression given through your journal and that it will be accepted as a statement of facts as I know them to be. W. J. LORING.

San Francisco.

## The Mineral Resources of Cuba

THE EDITOR:

Sir—In your issue of July 29 I noticed the article by Sr. Eduardo Suarez Murias, who states "comparatively little is known about Cuban mineral resources." This cannot refer to general knowledge, because numerous publications prove the contrary and the archives of the Mining Office in Havana contain very extensive information by well-known geologists and mining engineers. The object of my writing is to draw attention to some errors in the article.

The writer states that the limonite ore deposits, or reserves, in Oriente Province exceed 3,000,000 tons, and calculates the total for the island at 4,000,000 tons, although actual borings show 2,846,000,000 tons of limonite ore in Oriente province alone, distributed as follows:

| | |
|---|---|
| Spanish American Iron Co. | 1,403,500,000 |
| Bethlehem Steel Co. | 372,500,000 |
| Pennsylvania Steel Co. | 295,000,000 |
| Buena Vista Iron Co. | 300,000,000 |
| Piloto Mining Co. | 200,000,000 |
| Private owners | 275,000,000 |
| Total | 2,846,000,000 |

There are great tracts of such deposits not yet proven by borings which would materially increase the gross tonnage of ore reserves.

Hard iron ores, mostly magnetite, have been mined for many years by the Spanish-American Iron Co. and the Bethlehem Steel Co. The former up to April 30, 1917, mined 8,057,140 tons of ore, according to official statistics, with an average of 61 per cent iron, and the Bethlehem Steel Co. about the same quantity, the respective tonnages of reserves being 7,500,000 and 7,000,000.

In a small area on the south coast I proved in two mines about 7,000,000 tons outcropping. Taking all the workable deposits together, there is an immense quantity of iron ore in that district.

As to copper, the El Cobre mines started in 1547 and not in 1830. They were stopped by the confiscation of enemy property when the United States entered the war, incidentally destroying by this friendly act a very flourishing community of more than 4,000 inhabitants and ruining the entire town. During the last few years I have proved the continuation of the main El Cobre lodes for a distance of over 2 km. by shafts down to 235 ft. depth. I have further proved large deposits from 60 to 80 ft. wide in several other places, all being ore with a higher copper average than the average of all the United States reserves in 1920. Numerous copper outcrops are known, although some at places in the interior would be costly to open up.

I do not know in what way the Cuban mining laws are so defective as to retard progress in mining, as the writer of the article says. These laws are in force in Spain and enforced there, while in Cuba they are very leniently applied.

The principal trouble with mining in Cuba is that few responsible companies have started mining here with engineers experienced in opening new mines.

Santiago de Cuba. J. F. CARLOS ABELSPIES.

## True Talk from a Practical Miner

THE EDITOR:

Sir—I have read with interest in a recent copy of your journal some one's remarks on the shortage of skilled and intelligent miners, and maybe a few remarks by a miner might help clear a few doubts. In the first place, it might be well if young engineers were required to serve an apprenticeship on the muckstick and machine. I don't mean a summer vacation but several summers and winters. I'm acquainted with several young mining school graduates, and they seem to think the proper place to get experience in mining is either to keep time on the surface or watch the boys come out of the mines. A technical education may be good, but judgment in mining and an understanding of miners can only be gained by practice of the one and actual contact with the other. There is a Chinese proverb that used to receive consideration in dealing with miners: "If you employ a man, trust him, and if you can't trust him, don't employ him." In this day and age they spot your holes, give you the direction in which to drill them, and issue you a certain amount of powder to blast them with. In the hole that I am at present laboring in, there are four types of drilling machines in use in seventeen distinct stages of dissolution. A miner spends considerable time hunting for a machine and rig, then more time hunting for wedges and blocking; working one stope one day and another the next; receives orders to stope out ground several feet above the foot wall, and is presented with a jackhammer, which all intelligent miners think much of, and ordered to take up bottom the next day.

One reason for shortage of miners is the one man to a machine rule. I mucked eight months in order to get a job tending chuck, and tended chuck for a year before I had a chance to handle a machine and powder on my own hook. I was a very proud young buck the first day I got hold of a crank, but I'm not so proud now. Any fifteen-dollar-a-week clerk can travel in circles that I can't travel in. A dirty miner is one individual to be avoided at all times except on pay day, and then he should only be tolerated so long as his money lasts.

There are a few things that mining companies might take note of that would tend to increase the number of intelligent miners. Some of them are: A certain amount of respect for the intelligence that some miners

possess. Also, practical as well as technical men for general managers, superintendents and so forth. An intelligent miner hates like the devil to do work that is unnecessary and impracticable. Another thing is to foster pride in good work rather than to seek to have a large amount done in a slipshod manner.

The attitude of the mine management toward employees is indicated very clearly to employees by conditions in the change room and the quality of food served in company boarding houses where those things exist. Also where the company observes the ordinary laws of sanitation and ventilation, as well as safety laws, the employees have more of a tendency to do likewise. Another thing is Rules and Regulations for Employees: Rules should be sensible and reasonable and should be absolutely enforced. An employee who breaks rules and isn't penalized loses respect for rules and the management that makes them. FRED MOENCK.

Tonopah, Nev.

## Mining Booms

THE EDITOR:

Sir—The recent discussion concerning the boom at Oatman reminds me of others. Most mining booms have their scene of action in a gold- or silver-bearing region, the chance of making money quickly being much greater there than in a base-metal district. Generally, rich ore is discovered at one point, after which the ground surrounding it is staked for miles. Companies are organized by the score, and brisk trading and absurd rises in the price of shares follow. As the discovery claims continue to reveal more ore, the adjoining neighbors may find a little ore, whereupon the market booms and goes wild. This is why mining is termed a gamble by the unthinking public, especially by those who have been stung. On the other hand, in the aggregate a good deal of money is collected by the companies formed, machinery is purchased—helping business generally—work is provided for a large number of officials and men, and the ground is prospected in every direction, permitting the geology to be studied. No doubt the state corporation departments are kept busy watching the prospectuses and organization of the many companies, this being one of the safeguards for the speculating public.

What have been the results of booms in the past? Omitting the early activity on the Rand, and the rush to the Klondike, we can look back on a number of booms within the last thirty years. Cripple Creek, as a starter, has yielded gold amounting to about $400,000,000. The names Cresson, El Paso, Golden Cycle, Independence, Portland, Strong, and Vindicator have become almost household words among mining men. Next comes Kalgoorlie, in Western Australia, where British capital was sunk in millions sterling, but the total yield from an ore somewhat similar to Cripple Creek runs apace with the latter, and is equal to $380,000,000. No better mines have been developed than the Associated, Golden Horse Shoe, Great Boulder, Ivanhoe, Kalgurli, Lake View Consols, Oroya, Perseverance, and South Kalgurli. At about the same time was a boom at Waihi, in New Zealand, but the only mine that was opened—the Silverton—closed later, leaving only the present mines—the Waihi and Grand Junction, which had been opened earlier.

Early in the present century Jim Butler discovered what has resulted in Tonopah, a silver district that has yielded $140,000,000—including gold—and such mines as the Jim Butler, Montana, Tonopah Belmont, Tonopah Extension, Tonopah Mining, and West End. Following Tonopah came Goldfield, wherein the Goldfield Consolidated alone yielded $73,000,000. In northern Ontario next came Cobalt, another boom in silver. But what has it produced? Such mines as the Buffalo, Coniagas, Kerr Lake, La Rose, McKinley-Darragh-Savage, Mining Corporation group, Nipissing, Temiskaming, and Wettlaufer, a total of over 320,000,000 oz. of silver and many millions in dividends. Porcupine was next the scene of a gold rush, resulting in the Dome, Hollinger, McIntyre, Porcupine Crown, and Schumacher, and an addition of over $75,000,000 of gold bullion to the Dominion's once small total. Kirkland Lake had a considerable flutter, but has produced the Lake Shore and several other worthy producers.

A small yet reckless boom caught Australians again at Bullfinch, in the West, but only two mines of any note became producers out of the large number of companies bearing the names of various songsters, and they are now closed. Rochester, in Nevada, then came along, but the rush for this silver district was quite mild, yet we have the Nevada Packard, and the Rochester Mines and Combined, now the Rochester Silver. Oatman, Arizona, started one of the largest booms in recent years, fully 200 companies being organized to prospect there for gold, depth being necessary. Prior to this rush, the Tom Reed and Gold Road mines had been consistent producers, but when the United Eastern opened so well the excitement started. The really tangible result of the Oatman business is the United Eastern and Big Jim, now combined, and one or two other small producers; also the present discussion in the *Journal-Press*. The boom in oil in Wyoming, copper at Jerome, in Arizona; oil shale in Colorado, and the feverish excitement in Texas oil might be included here.

This brings us, late in 1917, to the scene laid at Divide, six miles south of Tonopah. This was early known as the Gold Mountain district, but had been almost neglected until, in the Tonopah Divide mine, rich silver ore was found. By September, 1919, about 300 companies had been organized with funds aggregating $3,000,000. Shares on Bush Street, San Francisco, soared to all sorts of prices. The net result is the Tonopah Divide mine, a regular producer, and opened to 1,400 ft.; also one or two other small producers. Anyhow, the public had a run for its money. About the same time (1919) a highly respectable boom started in the Salmon River district of British Columbia, yielding the great Premier silver mine, which is distributing a half million every three months; also the Dolly Varden mine. Then a wild boom started in 1919 at Hampton Plains, near Kalgoorlie, Western Australia. Visions of another Golden Mile, much speculation, geologic discussions and development of the Hampton Celebration, whose mill and cyanide plant recently started work, about sum up that affair. When and where will the next boom be?

As a whole, most booms in the past have been productive of many real mines and much valuable technical knowledge—both mining and metallurgical—but the reckless gambling on the part of the public, whereby it loses money, has given mining the odium of being a gamble; and while the public does not pause to consider the issues, considerable blame should be attached to the non-technical press, which rather urges—perhaps ignorantly and innocently by means of its news items—the speculation in unproved mining districts.

Pittsburgh, Pa. M. W. VON BERNEWITZ.

*View of Gold Hill Mine framing shed, stores, shops, and shafthouse*

# Ore Deposits of Gold Hill Mine, at Quartzburg, Idaho

## Geological Problems Many and Varied—Gold Hill Vein Considered Source of All Orebodies on Property—Present Workings Along Intersection of Fissures With Rhyolite-Porphyry Dike

By A. J. McDermid

THE REGION known as the Boise Basin is in an intermontane valley about twenty-five miles long and fifteen miles wide and lies thirty miles northeast of Boise, Idaho. The history of the district, full of interesting, adventurous, and often tragic incidents, begins with the death, at the hands of Indians, of the leader of the party of prospectors who discovered gold placers in the valley in 1862. In a few months thereafter the district was thickly populated with miners, gamblers, and desperadoes. The first were attracted by the richness of the placers, while the others, no less hopeful of easy wealth, hoped to gain it by less honest and easier methods than mining. The camps were prosperous. Gold was easily won from the ground, and before the end of the century the district had produced approximately $60,000,000, all but about $4,000,000 of which came from the placers. The smaller amount was produced by lode mines.

At present the placers are of minor importance compared with the underground mines. Considerable dredging has been done around Idaho City (Fig. 1), and there is a favorable area near Centerville that is as yet undredged. The chief activity, however, centers in the underground mines. Of these, the Gold Hill mine, at Quartzburg, is the most important. Since 1864 it has been continuously operated and is today the largest producer of gold in Idaho. Its total production to date is about $8,000,000, principally gold, with a very small proportion of silver. Gold is the principal metal mined in the district except around Banner (Fig. 1), where the ore is chiefly silver. In the vicinity of the Golden Age mine the gold is associated with lead and copper. I am not sufficiently familiar with all the mines of the Boise Basin to write a comprehensive article on the district, but I hope that the following remarks about the Gold Hill mine will be of some benefit to others engaged in mining in the district as well as to those in other localities who are interested in gold mining.

The most important geological feature of this mine is the Gold Hill vein, which is generally considered to be the source of all the orebodies in the mine. This vein is from 2 to 6 ft. wide. It strikes north 65 deg. east and dips slightly to the south. It is a member of the system of fissures which has been explored for several miles southwest and northeast of Quartzburg. For the first eleven years of the mine's operation surface workings of the Gold Hill vein and of the Last Chance (a vein parallel to the Gold Hill and 50 ft. north of it) yielded ore said to average $20 a ton. In that early day the ore was first broken fine enough for stamp milling by means of double-jacks. After it had been crushed in the stamp mills 60 or 70 per cent of the gold was recovered by means of amalgamating plates and the rest was allowed to go down the creek. The ore therefore, had to be of good grade to yield a profit.

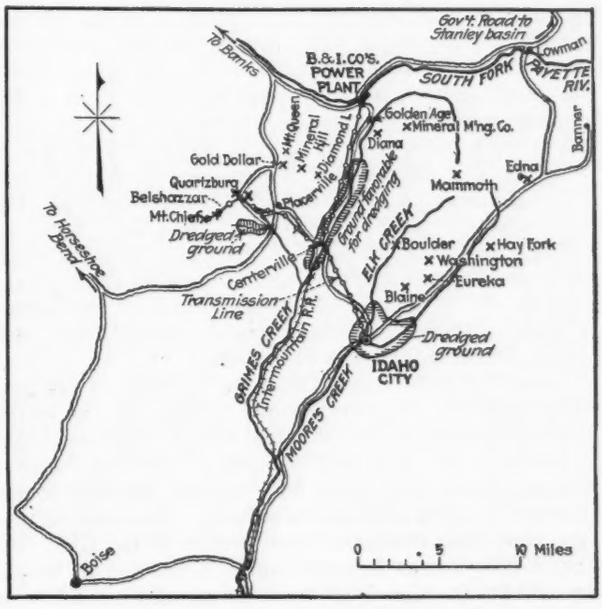



*Fig. 1. Map of Boise Basin*

The principal rock of the locality is an altered and fractured granite into which have been intruded dikes and chimneys of rhyolite porphyry and diorite porphyry. The general direction of these dikes is east and west and their most common width 40 ft. They dip about 80 deg. north as a rule. Sometimes at a junction of two dikes their combined width is from 100 to 200 ft. There is one rhyolite porphyry outcrop which is 300 ft. wide. Some of the dikes are lenticular in shape, and others have been found to extend with fairly uniform width for over 2,000 ft. One rhyolite-porphyry dike is cut by the Gold Hill vein (as in Fig. 2), so that in places there is from 10 to 20 ft. of rhyolite north

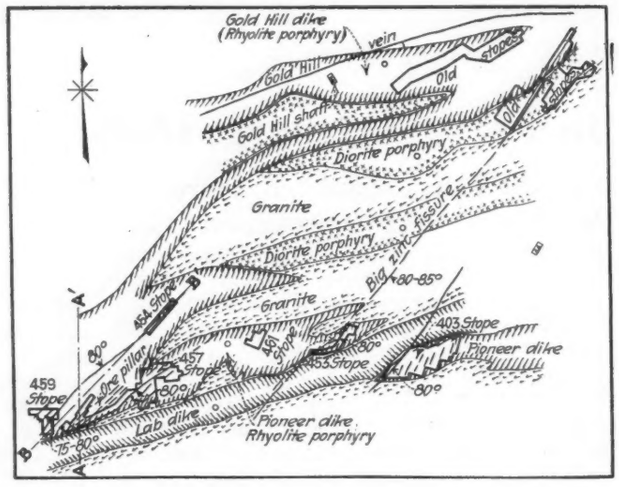



*Fig. 2. Plan showing geology and outline of stopes on 400 level of Gold Hill mine*

of the vein. Aside from this instance there is no evidence of there being any rhyolite porphyry north of the Gold Hill vein for at least 2,000 ft.

### Albite Formerly Mistaken for Labradorite

Paralleling the Gold Hill vein and 300 ft. south of it lies a dike whose most noticeable characteristic is the presence in it of large white crystals of albite. These crystals are commonly half an inch long and often take the form of Carlsbad twins. This dike is called locally the "Lab" dike because at one time the large white crystals were thought to be labradorite. It is about 40 ft. wide, dips slightly to the north and strikes a little north of east so that it cuts several rhyolite porphyry dikes at an acute angle. The rock in this dike was probably granite originally, but has been so strongly metamorphosed hydrothermally that the black minerals have disappeared, leaving the albite and quartz crystals in a fine-grained ground-mass. The albite crystals, although retaining their crystal form, are almost completely altered to sericite.

Along the Gold Hill vein in the vicinity of Quartzburg numerous smaller fissures branch to the south with an average strike of north 45 deg. east and a dip of 80 deg. east. Where these fissures intersect the rhyolite-porphyry dikes they have caused fracture zones, in some of which gold was deposited. Orebodies of this type were first discovered and worked in the Gold Hill dike. They varied in width up to 30 ft. and in length up to 150 ft. Some of them have been mined to a depth of 560 ft., which is as far as exploration has gone.

The orebodies being mined at present are those that occur along the intersections of fissures with the rhyolite-porphyry dike, called the Pioneer dike. This dike shows the effects of much hydrothermal alteration and is leached in many places to a creamy white color. The rock is principally a fine ground-mass in which are scattered crystals of quartz and feldspar. The feldspar crystals are so completely altered to sericite that their exact original composition cannot be determined. In some places cubes of secondary pyrite have been formed as a result of the hydrothermal alteration. This dike shows the effect of hydrothermal alteration much more than does the Gold Hill dike. The former is softer, more leached, and contains more fissures than the latter. This alteration seems to have made the Pioneer dike more permeable for the ore-bearing solutions, as its orebodies are wider as a rule than those in the Gold Hill dike. Stopes in the more altered dike must be filled as soon as they are mined, whereas some stopes in the Gold Hill dike were not only left open but the timbers were removed after the ore had been extracted.

### Gold in Pioneer Dike Orebodies Found in Small Fissures

In the orebodies of the Pioneer dike the gold occurs in small fissures varying in width from a knife blade up to two inches. The porphyry is generally more leached and altered in the ore zones than elsewhere, and in these zones the seams are easy to follow. Where they pass into granite or into darker, less-altered porphyry they become so small and indefinite that they are soon lost. Generally, in each orebody there is one fissure which is larger and longer than the rest. It can be followed not only in the porphyry dikes but in the granite as well, in some cases for hundreds of feet (for example, the Big Zinc fissure of Fig. 2). The larger fissure rarely contains much of value. Evidently the ore-bearing solutions came up through the large fissure and penetrated out into the smaller fissures before they cooled sufficiently to deposit the gold. There are numerous small faults with displacements of a few inches at right angles to the ore fissures, but the faults contain no values.

The vein filling in the small fissures is chiefly quartz sprinkled with stibnite and pyrite. The larger fissures usually contain no stibnite, but pyrite is abundant and sometimes gouge is found in them. The gold is rarely visible, but is scattered through the stibnite in a finely divided state. It is not unusual to have a half-inch fissure, in which no gold can be seen, yield a sample which will assay over $5,000 per ton. In some of the seams there has been no movement along the strike since the ore was deposited, as the vein matter is not broken up. In others, there has been enough movement to powder the ore, but rarely enough to appreciably increase the width of the fissure.

### Samples Across Face of Drift Unreliable

It has not been found possible to take reliable samples across the face of a drift or the width of a stope, because the values are all concentrated in a few small seams, the adjacent country rock being valueless. The ore is followed by panning samples from the seams and by noting the character of the rock. Sphalerite is often present in the fissures near the end of an orebody, and is an indication of a decline in value of the vein in which it is found. Numerous pannings are necessary,

and small prospect drifts must frequently be driven from the sides of the stopes to determine the limits of the ore. The color of the porphyry is often no criterion, because there are sometimes found blocks of creamy white porphyry which ought to contain ore, but in which, unfortunately, no ore fissures exist. It sometimes happens that the values in one seam will continue past the main ore zone, and when this occurs a narrow cut-and-fill stope is used. The ore in these cases is better than average because in the narrow stope it is possible to mine less waste than in the wide stopes.

### Filled Square-Set Method Used

The rock is easy to break, and were it not for the lack of definite walls could probably be mined by a caving system. The method used is the filled square set. Under this system, barren ground can be left in place and much of the waste can be sorted out in the stopes and used for filling.

Since the Gold Hill vein was worked out, little ore has been found that did not lie in the rhyolite porphyry. In a few cases fissures in the granite, diorite porphyry, or the "Lab" dike have yielded ore, but as a rule the deposits were not of large extent, although some of them were very high grade.

The foregoing is true, in general, of all the orebodies in the Pioneer dike, but that does not mean that all the orebodies are exactly similar. Each one has characteristics peculiar to itself. In the orebody indicated by 454 stope in Fig. 2, three definite fissures have been mined from the 500 level to surface, and each fissure maintained its identity all the way up. In 453 stope the ore seams are indefinite. They die out in places or intersect other fissures or faults so that they cannot be traced far. The main fissure in this orebody is called the Big Zinc fissure. It is from a few inches to 3 ft. wide and contains masses of sphalerite often several feet in length. The vein matter of this fissure

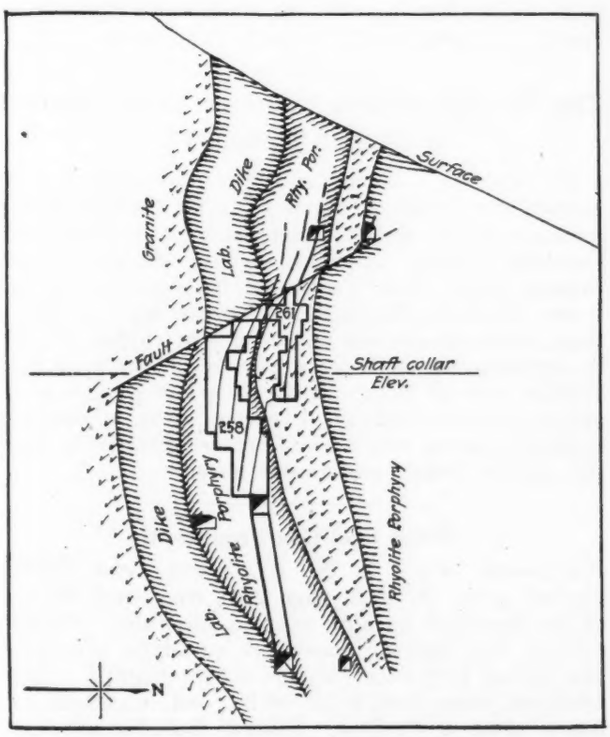



*Fig. 3. Vertical section "C," looking west*

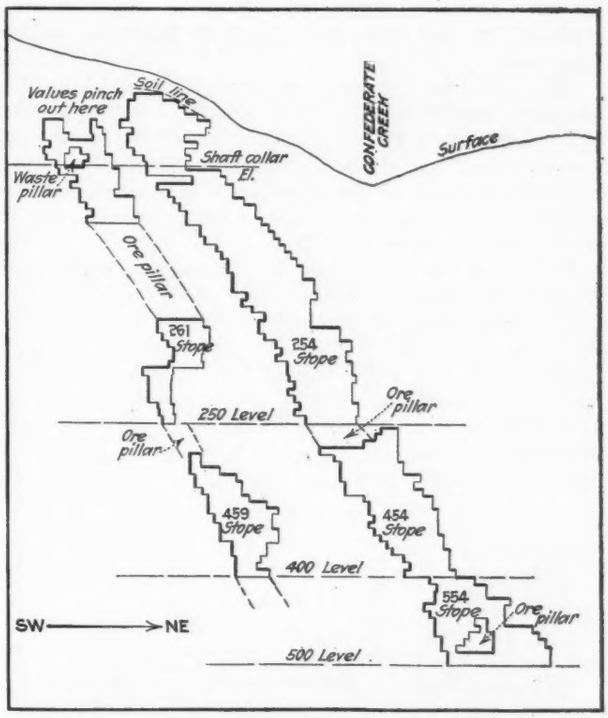



*Fig. 4. Vertical section "BB," looking northwest*

contains little of value, most of the gold being in the small seams of the fracture zones which lie adjacent to the big fissure in the rhyolite porphyry. In Section *C* (Fig. 3) is shown a section of a stope (No. 261) which lies wholly in granite. In 457 stope (Fig. 2) the large fissure contained better values than the small seams.

Section *BB* (Fig. 4) is a longitudinal section of the two orebodies indicated in Fig. 2 by stopes 459 and 454. The ore seams strike northeast and dip east, while the rhyolite porphyry dikes have an east-west strike and a north dip. As a result the orebodies trend to the northeast with depth. In order to show the limits of the two orebodies mentioned, throughout their depth in a vertical section, the stoping on either side of the plane of the section has been projected to the section.

### Effect of "Lab" Dike Not Understood

The part played by the "Lab" dike in the making of the ore is not as yet well understood. Solutions which emanated from this dike when it cut through the Pioneer dike are evidently responsible for the hydrothermal alteration of the rhyolite, because the leaching of the latter is always more pronounced near the "Lab" dike. The latter dike is probably not the source of the ore, as there is no general ore zone throughout the distance over which the two dikes are adjacent, but from the manner of its intersection with the Pioneer, it is inferred that the "Lab" dike was at least a fracturing agent and also acted as a dam, because some orebodies lie up against it (for example, 403 stope, Fig. 2). Exploration of the intersection of the "Lab" dike with the Gold Hill dike is contemplated, and this work will doubtless yield valuable information.

Development of the 600 level, to which the shaft was recently sunk, is being delayed on account of the destruction by fire of the hydro-electric plant at Grimes Pass. The mine partly filled with water, but as power

is now available again the water is being rapidly pumped out, and the mine should be ready to resume work soon.

The geological problems presented in the Gold Hill mine are numerous and varied. Old Mother Earth often hides her riches with exasperating subtlety, but who can say that mining is unromantic and uninteresting when the solution of these problems may mean the discovery of a bonanza, or at least a little self-satisfaction to the one who solves them?

Milling of the ore is simple. Seventy to eighty per cent of the gold is recovered by amalgamation in an 8-ft. x 18-in. Hardinge conical mill, which is revolved at the rate of eighteen revolutions per minute. The mill is lined with cast-iron plates and manganese-steel lifter bars. The grinding is done with jasper pebbles, as steel balls tend to flour the quicksilver. The latter is fed into the scoop of the mill in small quantities at regular intervals. After leaving the Hardinge mill, the

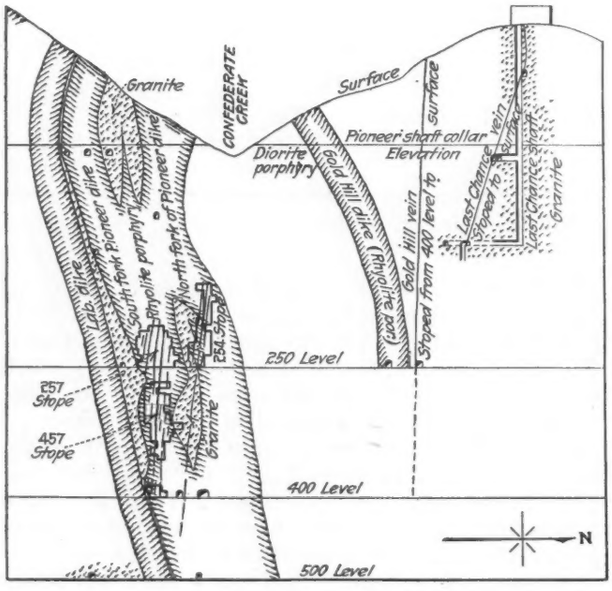



*Fig. 5. Vertical section "AA," looking west*

ore is passed over amalgamating plates and is then concentrated on four Overstrom Universal tables. The concentrates are ground to pass 100-mesh in cyanide solution in an 18-ft. x 4-ft. tube mill. The ground concentrates are agitated by air in Pachuca tanks. The pulp is then allowed to settle, the pregnant solution is decanted off, and, after being deprived of its gold in the zinc boxes, the effluent solution is run into barren-solution storage tanks. From 10 to 20 per cent of the gold is recovered in the cyanide plant, and the total extraction is from 90 to 95 per cent. The mill has a capacity of 175 tons or ore and the cyanide plant a capacity of ten tons of concentrates per twenty-four hours.

The Gold Hill company maintains a modern store in Quartzburg as well as a radiophone station. Hydroelectric power is abundant, and many of the buildings of the town are heated by electricity. Mining timber is plentiful and cheap.

The Boise Basin in general was well known as a gold-producing area before the war, and is again becoming a center of mining activity as a result of the decreasing cost of labor and supplies.

## Gold and Diamond Mining in South Africa on the Mend

According to a report from U. S. Trade Commissioner Perry J. Stevenson appearing in *Commerce Reports*, the gold mines of South Africa are making good progress. With the increase in output and the decrease in operation costs it is anticipated that within a short time this industry will be on its feet. The decrease in the cost of operation has injected a healthy confidence in this South African industry, as serious apprehension was entertained on account of the continued reduction in the premium on gold. The decreases in production costs have led many to the opinion that even if gold returns to its standard basis, namely, 85 shillings per fine ounce, the industry can still operate profitably. In July the gold production in the Transvaal amounted to 730,635 fine ounces and exceeded that for any month since July, 1920. Taking £4 11s. 9d. per ounce as a basis of valuation for gold, the July output is valued at £3,335,520. Gold production shows convincing signs of complete recuperation from the effects of the recent strike. Employment in the gold mines is on the increase. During the month of July 172,886 native laborers were employed as compared with 170,464 during June.

The final outcome of the approaching referendum, to be held next October, concerning the annexation of Rhodesia to the Union of South Africa, continues to be a point of much agitation throughout the Union. The South African press has dwelt quite extensively upon the advantages which Southern Rhodesia will acquire by annexation. These comprise extensive railway improvements, road construction, and lower taxation.

Diamond sales continue good, but there is little prospect of immediate resumption of general diamond mining. Reports from the Continent indicate that diamond stocks there are almost depleted, owing partially to the purchases of American and other tourists. Heavy shipments have already been made to that market.

## The World's Oldest Commercial Institution a Copper Company?

According to a recent newspaper clipping, the oldest industrial company in the world is a Swedish copper company known as Stora Kopparbergs Bergslags Aktiebolaget, which, according to its letterhead, was founded in 1225 A.D. Translated, it means the Greater Copper Mountain Mining Co. The company has always been primarily a miner and refiner of copper, though the business has extended into many lines. It is said to be strictly up to date in the matter of welfare work and to maintain hospitals, libraries, baths, schools, cooperative stores, recreational centers, children's summer country homes, and garden plats.

### Wood Fuel Gas Producers

A recent article in the *Engineering and Mining Journal* (Feb. 18, 1922, page 290) mentioned the use of gas producers burning wood in Australia. Further reports state that all classes of industries are using gas engines with wood fuel gas in that country. These producers range from 50 to 300 hp., and, in general, use billets about 2 ft. long. Several manufacturers are marketing equipment adapted for this work.

# The Development of the Vertical Disk Crusher

## Early Types of Machines Used at Inspiration and Ajo Were Promising and Gave Excellent Product for Leaching—Latest Models Have Counterbalanced Bronze Rolling Wedge With Outer Shaft Carried in Ball Bearings

BY DAVID COLE

WHILE experimentally developing a proper process and scheme of flow for the Inspiration concentrating plant, a 600-ton pilot mill was operated, and in this mill a great many different crushing and grinding machines were tried out. Among others, were three different types of fine-crushing machines manufactured by Symons Brothers, one of which was their so-called vertical disk crusher. This machine ran throughout the testing period and survived the ordeal with considerable credit. The other types were not so successful.

The vertical disk crusher above referred to was constructed as shown in Fig. 1. The new idea of making use of centrifugal force for hastening the exit of the finished material was incorporated in it, and as a first model in a machine departing so radically from conventional crusher design it was an unusually well-developed piece of apparatus, though some structural weaknesses developed in practice, as would normally be expected.

The machine was arranged with a single point of final delivery for the finished product, involving the use of scrapers which rotated at high speed for moving the material for a considerable distance to the discharge opening. These wore quickly and proved troublesome.

The rolling wedge is the most important member of the mechanism subject to severe strains and wear. A mold for recasting the babbitt needed on this part of the machine would be a large and expensive piece of apparatus, and the purchaser of a single machine

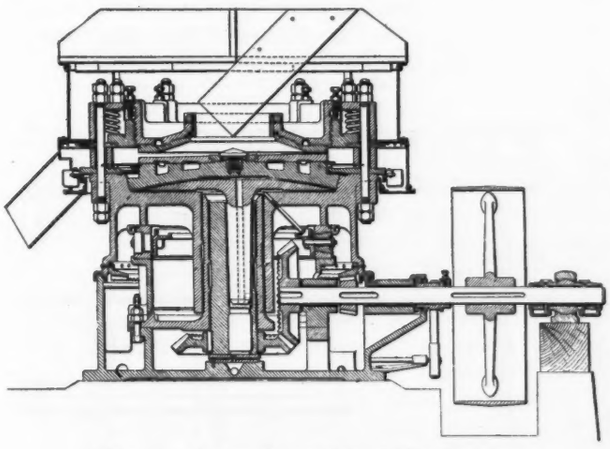


*Fig. 1. An early model of the Symons vertical disk crusher*

would be put to burdensome expense if he were compelled to buy such a mold. Symons Brothers therefore undertook to devise means whereby standard babbitt plates could be furnished by the manufacturers for insertion in the rolling wedge when necessary to restore its wearing surfaces. The attempt was based on logical reasoning, but was not successful in practice. The plates became loose, worked out of their seats, mixed with each other, and were destroyed; and the oil passages were clogged with shredded babbitt so that circulation was hindered; in consequence of which the machine was too often "burned." The "outer shaft" was a heavy and unnecessarily long quill, which prevented the proper bracing of the sleeve that supported

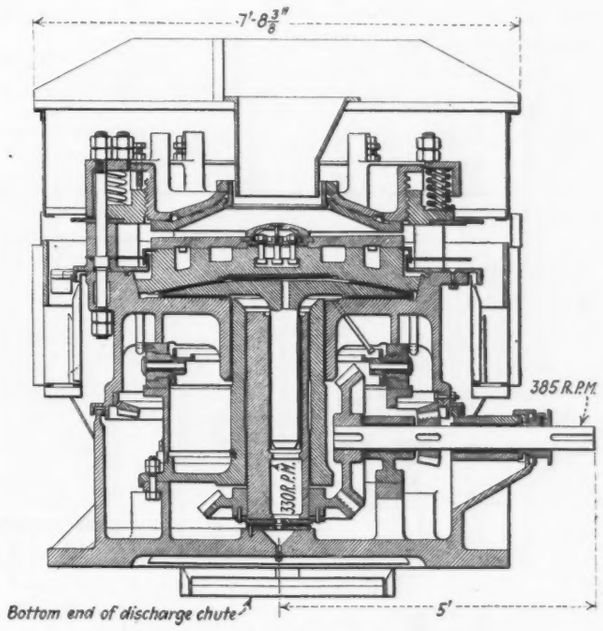



*Fig. 2. Remodeled disk crusher*

it. The only method available for changing the set of the jaws proved weak and inconvenient, and the provisions made for holding the set were inadequate; the springs were too weak, the tension bolts needed collars to hold the compression of the springs within the cage, and other minor alterations were evidently necessary.

During the experimental period that preceded the erection by the New Cornelia Copper Co., of the 5,000-ton crushing and leaching plant at Ajo, a Symons vertical disk crusher—which was a duplicate of the one used in the Inspiration experimental mill—was purchased for use in preparing the ore for the leaching experiments. Quite naturally, the experimental work and thought was mainly concentrated on metallurgical problems in which the engineers were pioneering. When it later became necessary to make a decision as to what type of machine should be used for the intermediate and final crushing in the large plant, several important mechanical factors required consideration.

It was particularly recognized that the product of the disk crusher was especially suited for leaching purposes. The metallurgists were naturally concerned about any chance for change in the character of the "crush," and were partial to the disk machine, but

it was considered too new a candidate by others. Rolls, on the other hand, had been improved during a long period, in consequence of experience in various districts and under widely different conditions, and were being built to meet all customary conditions. Would rolls be better than the disk crusher that was used in the preliminary tests with such excellent results?

Little relevant data were available to use for the purpose of making comparisons of cost, output, and flexibility. Experience with rolls at the Miami, Ray, Chino, and Utah Copper plants was found to be of little value because the orebodies in question are shattered masses of relatively soft rock containing ribs and lenses of more siliceous, and therefore less altered, portions, affording large percentages of what might be classified as natural fines, which greatly reduced the proportion to be handled by the finishing machine. The Ajo ore, on the other hand, was recognized to be of uniform texture, hard throughout, so its reduction to ¼ in. would therefore be a more strenuous task.

If rolls were used, the high-carbon rolled-steel shells of standard practice would corrugate badly, so that frequent renewal would be necessary. Manganese-steel shells would be impracticable because they also would groove and could not be re-faced except at considerable cost. With roll equipment, if too severe shocks were to be avoided, stage crushing would need to be carried to an extreme, making the plant much larger and more expensive. However, the experimental factor would be less in the use of rolls for such a purpose. Many engineers were and are enthusiastic advocates of this type of crusher, especially for the reduction of the usual type of porphyry ores, but there is less enthusiasm among metallurgists who are responsible for the results obtained from the leaching of the mixed product.

## Improving the Disk Crusher

Early in 1915 I was consulted by the New Cornelia Copper Co. as to the proposed crushing and leaching plant about to be erected at Ajo. Feeling that the vertical disk crusher was fundamentally sound and that the weaknesses developed in practice could be satisfactorily eliminated by improvements in detail, I advocated its adoption provided I was given a free hand in redesigning it. Chalmers & Williams, Inc., manufacturers of the new crusher, were, on their part, willing, and I was given a commission to remodel the machine and to design it into the fine-crushing section of the Ajo plant.

With the co-operation of J. G. Bergman, my chief engineer, the machine was entirely remodeled in detail as shown by Fig. 2, and the simple arrangement of plant incorporating these crushers shown in the illustration (Fig. 3) was adopted. Although some operating troubles were experienced at first, these were but a small fraction of what they would have been had a plant using rolls been used in place of the Symons disk crushers, for following the first few months of operation, the gyratory plant preceding the disk crushers was temporarily embarrassed by the failure of the oiling system, burned bearings, serious scoring of the

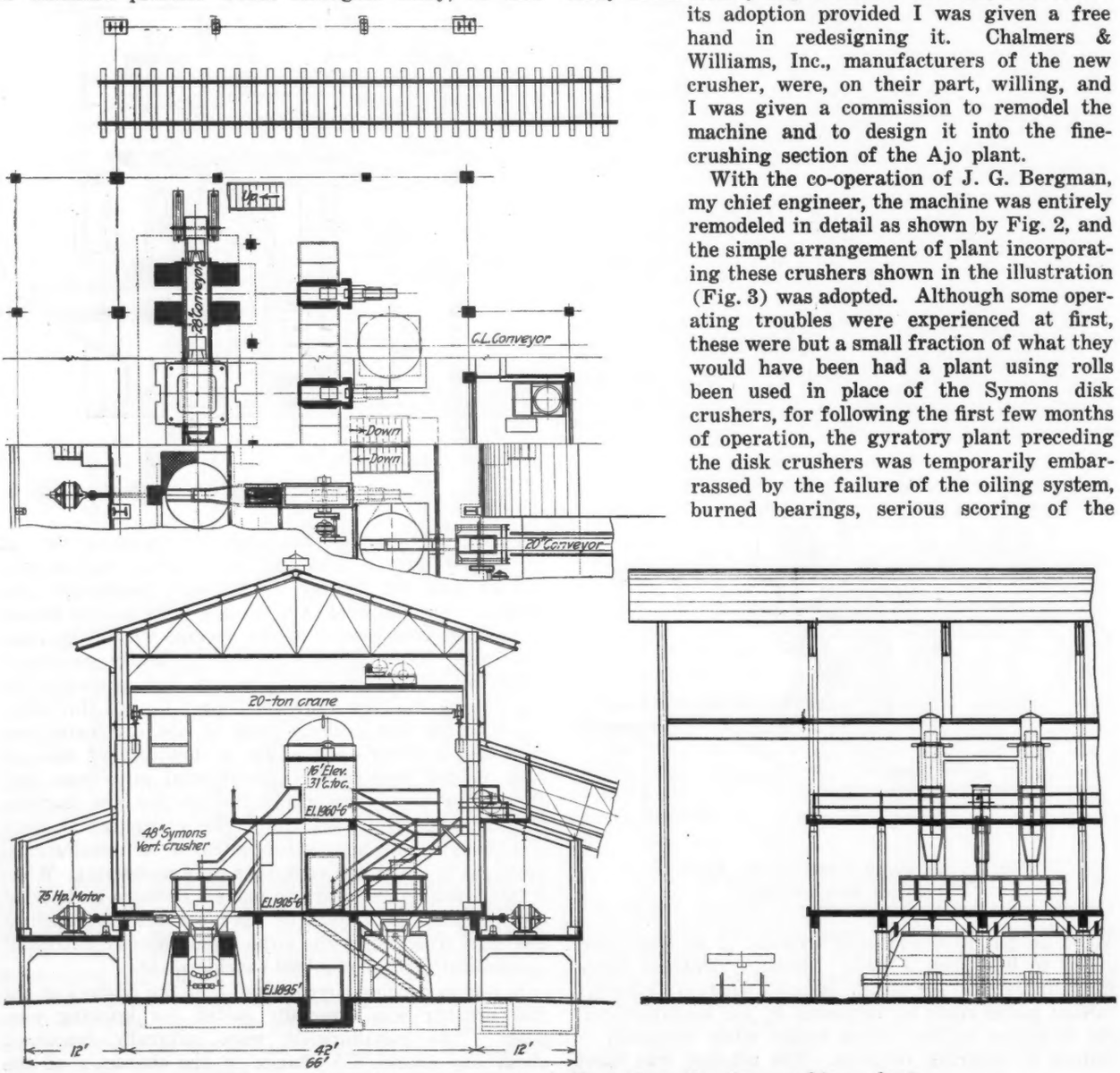



*Fig. 3. General arrangement of New Cornelia fine-crushing plant*

journals, and considerable reduction in the throw of the eccentrics of the No. 8 machines. These troubles resulted in a marked decrease in their capacity, making it necessary temporarily to open them to the largest possible dimension in order to handle enough ore to supply the leaching plant with the required amount, even when the primary crushing operations were extended from the anticipated eight hours per day to sixteen hours' operation. The result was that the product to the Symons machines was as coarse as 5 in., instead of 3½ in., as originally planned. To cope with this situation the primary disk crushers in the series in the fine-crushing plant were opened so that the product would be coarser than usual, thus throwing more work upon the two fine-crushing disk machines that followed, and pending receipt of parts needed for restoring the gyratories, these units of three Symons machines performed the extraordinary duty for some months without difficulty.

The percentage of coarse material in the feed at Ajo, at all stages of crushing, is much larger than the average. This is because the ore is uniformly solid rock and all has to be crushed. Hence the reduction of 100 tons per hour from a maximum 5 in. to a product containing 15 per cent plus-3 mesh, through a two-stage unit consisting of one coarse and two fine disk crushers, was a creditable performance. No two-stage arrangement of rolls could be so flexible as that, and flexibility, as was proved by the above experience, is an important asset.

### Preventing Damage by Tramp Iron

In operating fine-crushing plants it is necessary to make provision, by means of magnetic devices, against the accidental delivery of steel into the machines. This is somewhat more important in plants using the Symons crushers than in those using rolls. Magnetic head pulleys alone are not always sufficient, nor are they entirely reliable in their accredited field, but more powerful and longer-range stationary magnets, used in conjunction with well-made magnetic head pulleys, afford adequate protection except in the presence of manganese steel; this, being non-magnetic, passes the magnets and is troublesome. At Ajo, the lesson was learned from experience, for during the first few months of operation there was much trouble, even in the coarse-crushing plant, from the presence of broken manganese dipper teeth, drill steel, railway joint bolts, fishplates, and other "tramp iron." Checking the steam-shovel dipper teeth after the loading of each train of ore has become a standard practice of the "pits." The magnetic head pulleys—which are used subsequent to coarse crushing—soon failed and had to be rewound; stationary magnets were added to the defences, and the ore now passes under two large stationary magnets and over two powerful magnetic head pulleys before it reaches the first Symons machine. When these defences are kept in good order there is little chance that tramp steel other than manganese will reach them; but before the operators had been educated to realize the importance of keeping the steel away from the crushers, and had learned how to handle the machines after it had reached them, there was considerable trouble. Gears and pinion-shaft bearing pedestals were broken too frequently, and cost for repairs was high—but with more experienced operators and improved organization the difficulties have disappeared.

The first set of foundation blocks under the crushers proved to be faulty; they were used for nearly a year but had to be renewed finally. When this was done, they were all tied together; and provision was made so that the line of foundations for the finishing machines would form a gallery containing the belt conveyor that conveyed the finished product from the plant. By providing doors for the side openings in this gallery, an opportunity was afforded to attach and make good use of an exhaust fan, which created a slight vacuum in the gallery and caused the air to be sucked into all the openings of the housings in the crusher and elevator systems, thus clearing the crushing room of dust. A standard "cyclone" system for collecting the dust carried out by the exhauster was designed, the collecting apparatus being arranged directly over the conveyor that takes the final product to the leaching vats. A small stream of collected dust was to be released by a trap feeder attached to the lower end of the cone. This dust passed to a water mixer, which would in turn deliver it, in a small stream of viscous fluid, on the ore traveling on the belt conveyor, where the excess moisture would be quickly absorbed and be of benefit. Before a decision as to the best type of settling apparatus was reached, a wooden dust chamber with burlap partitions was installed as a collecter. This was found inadequate, and conical settlers were added; the exhauster has suction connections through a large "cyclone" settler designed to trap the sandy material before it reaches the fan. The discharge from the fan is diverted from the wooden dust chamber to a pair of cyclone "heads" for removing further dust; the air discharged from them is turned down into the chamber.

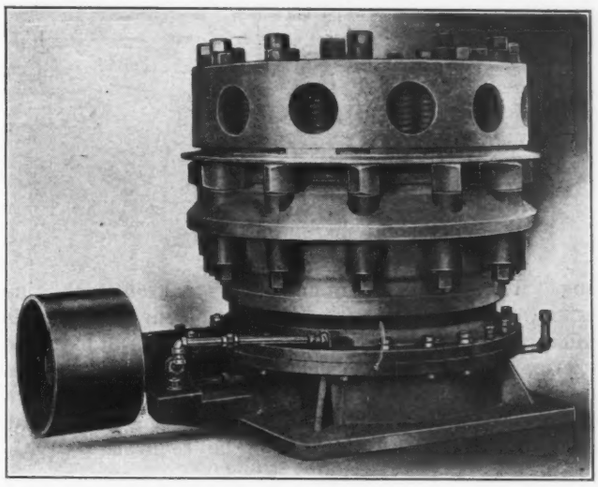


*Fig. 4. Improved type of 36-in. vertical disk crusher.*

### Further Progress in Design of Disk Crusher

The proper crushing of ore for leaching is so important, and the fundamental idea underlying the operation of the disk crusher is so sound, that a further modification in design was justified. Fig. 4 and Fig. 5 show a new improved type of machine that has been designed. The rolling wedge of the standard 48-in. machine weighs 1,600 lb.; it moves in an eccentric path and cannot be counterbalanced. The new one is entirely of bronze, is much lighter, and is counterbalanced by an adequate amount of metal on the opposite side of the actuating eccentric. The outer shaft of the new design, it will be noted, is carried on ball bearings instead of on rollers. Both upper and lower jaws are

conical, so that they can be zinked in place, thereby avoiding the expensive "finish" grinding of manganese-steel parts. The design of the housing has been altered, with improved results. The important bolts in the frame are on the outside, where they can be seen, and tightened if necessary while the machine is running. The main pinion has a journal on each side instead of being overhung; the circulating oil pump is inside and is driven by a silent chain as in automobile practice; all moving parts have been protected from the entrance of grit or dust. When these features are incorporated in a larger machine it seems likely that a considerable improvement will be realized.

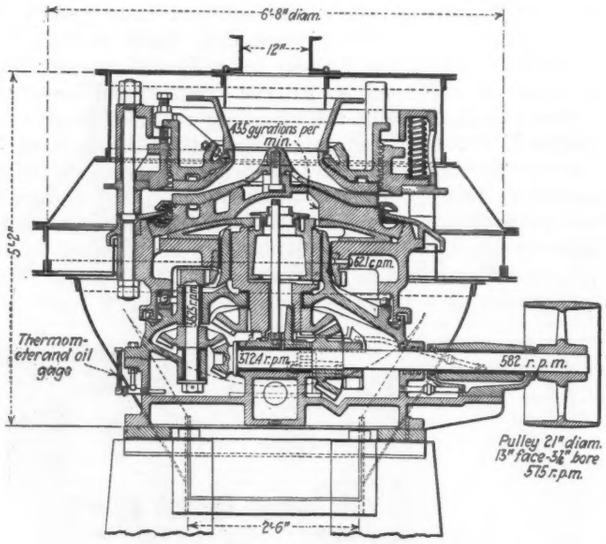



*Fig. 5. Design of the new 36-in. crusher*

## The Improved Condition of the Witwatersrand Gold Mines

In a recent issue of *The Statist* (Aug. 12), statistical data on the Witwatersrand gold mines are presented. The writer directs attention to what someone has called the three degrees of falsehood—viz., lies, damned lies, and statistics; and admits that in dealing with statistics caution and judgment are necessary. It would be wrong, for instance, to put too much weight on a reduction in the working costs per ton. By sending up unpayable ore it is easy to bring working costs down which are calculated on a tonnage basis. It is, of course, the profit which really matters. And in determining the most profitable scale of operations, where the line should be drawn in the mine between ore that is to come up and ore that is to stay behind, the mining engineer has to exercise much judgment.

In Table I the yield and cost of the whole of the Witwatersrand gold mines for the month of May, 1922, are compared with those of 1921 and 1913, which latter year was not an ideal one to select as typical of pre-war conditions owing to its industrial disturbances, but better perhaps than 1914, owing to war conditions in the later months.

It will be seen that the average yield in May was better than either of the years given, taking gold at par value, and that working costs are below those of 1921, but above those of 1913.

The premium, which in 1913 was absent, was 6s. 9d. per ton in 1921 and 2s. 4d. in 1922. The net working profit, which was much the same in 1913 and 1921, was about 1s. less per ton in 1922.

Table II is introduced to show the reduction in cost during May, 1922, as compared with the average of 1921. Gold last year averaged 107s. per oz. as against a price perhaps of 92s. this year; a fall, therefore, of 15s. per oz. By examining the third column it will be seen what mines have reduced their working costs to balance the loss in premium. Several have succeeded, such as Randfontein Central, Village Deep, Robinson, Witwatersrand Deep, and others come near it. But a considerable number of mines have not reduced their costs in proportion to the fall in the price of gold, and their profits this year will accordingly show a material reduction.

TABLE I

| | 1913 | 1921 | May, 1922 |
|---|---|---|---|
| Tons milled | 25,628,432 | 23,400,605 | 1,772,793 |
| Revenue from gold at 84s. per oz. | 27/7 | 28/5 | 29/0 |
| Costs per ton | 17/11 | 25/8 | 22/8 |
| Profit per ton | 9/8 | 2/9 | 6/4 |
| Gold premium, above 84s. per oz., per ton | .... | 6/9 | 2/4 |
| Working profit | 9/8 | 9/6 | 8/8 |
| Dividends | £8,205,199 | £7,163,941 | .... |
| Dividends per ton | 6/5 | 6/1 | .... |

A table of working profits shows that while some of the mines have earned less during July than the average of 1921, a considerable number show substantial gains. Crown Mines and Randfontein Central made especially good returns in July, as also did the Consolidated Main Reef, whose profit was described as extraordinary, due to temporarily abnormal grade combined with increased tonnage and reduced costs. Robinson Deep's profit in July was £30,000, as compared with £15,634 in June. Judging by the figures given, it appears that the profits for the second half of the year will show an improvement over the average profits of 1921. The dividend distributions, however, may not be so handsome as last year, in consequence of the purchase in many cases of ex-enemy shares.

TABLE II—SHOWING COST PER OUNCE OF FINE GOLD IN 1921 AND MAY, 1922

| | 1921 | May 1922 | Reduction |
|---|---|---|---|
| Gelenhuis Deep | 99/8 | 89/8 | 10/0 |
| Durban Roodepoort Deep | 99/3 | 87/0 | 12/3 |
| New Gooh | 96/5 | 86/0 | 10/5 |
| Randfontein Central | 96/3 | 79/0 | 17/3 |
| Village Deep | 95/8 | 76/9 | 18/11 |
| Simmer and Jack | 94/11 | 110/0 | 15/1 (a) |
| New Kleinfontein | 93/9 | 87/11 | 5/10 |
| East Rand Proprietary | 93/5 | 89/9 | 3/8 |
| Robinson | 93/2 | 72/7 | 20/7 |
| Wolhuter | 92/8 | 94/7 | 1/11 (a) |
| Nourse | 92/7 | 78/4 | 14/3 |
| West Rand Consolidated | 92/3 | 83/10 | 8/5 |
| Knights Central | 91/3 | 85/4 | 5/11 |
| Aurora West | 91/0 | 79/10 | 11/2 |
| Rose Deep | 88/7 | 78/2 | 10/5 |
| Witwatersrand | 87/6 | 72/7 | 14/11 |
| New Unified | 86/11 | 83/7 | 3/4 |
| Witwatersrand Deep | 86/3 | 71/2 | 15/1 |
| Consolidated Main Reef | 85/8 | 83/11 | 1/9 |
| Robinson Deep | 85/7 | 78/7 | 7/– |
| Van Ryn Estate | 84/5 | 82/0 | 2/5 |
| New Primrose | 83/0 | 87/9 | 4/9 (a) |
| Langlaagte Estate | 82/1 | 71/7 | 10/6 |
| Consolidated Langlaagte | 81/10 | 82/4 | –/6 (a) |
| Crown Mines | 79/1 | 71/11 | 7/2 |
| Modder East | 78/10 | 92/7 | 13/9 (a) |
| City Deep | 68/10 | 61/2 | 7/8 |
| Brakpan | 66/9 | 53/2 | 13/7 |
| Springs | 64/0 | 63/6 | –/6 (a) |
| Geduld | 58/10 | 58/3 | –/7 |
| Modder B | 53/7 | 46/6 | 7/1 |
| Government Areas | 49/1 | 39/8 | 9/5 |
| Van Ryn Deep | 49/1 | 43/7 | 5/6 |
| New Modderfontein | 46/7 | 44/8 | 1/11 |
| Meyer and Charlton | 42/6 | 42/1 | –/5 |
| Modder Deep | 39/6 | 36/3 | 3/3 |

(a) Increase.

The satisfactory feature is that the industrial situation has been improved, so that in the coming year more favorable results may be expected.

# An Illustrated History of Mining and Metallurgy—IV*

## In Sixteenth Century America—Practices of the Incas and Improvements by the Spaniards —The Discovery of Potosi—Acosta Describes the Amalgamation Process and the Use of Quicksilver in Smelting Silver

BY H. H. MANCHESTER

WHEN THE SPANIARDS discovered Central America, Mexico, and Peru they found the natives using gold much as they did copper, and valuing it little if any more highly. Silver also was in use, but the natives knew nothing of iron, and when first made presents of iron hatchets, and other tools, valued them more highly than they did gold because of their greater usefulness. The Incas had pots, cups, flagons, and even chairs and litters of gold, to say nothing of many images of their gods. This was not because they valued gold more highly, but because it was capable of being easily worked into such forms.

The methods of mining were very simple. Peter Martyr says that in getting gold from streams, the Indians simply gathered up the sand in their hands, and shifted it from one hand to the other until most of the sand flowed out.

The Incas smelted by means of furnaces without any chemical processes. They used blowpipes, though not bellows, avoiding the employment of the latter by placing many of their furnaces on the side of a hill where the wind would blow the fire. The blowpipes were used more for the small furnaces in which the metal was melted so that it might be cast.

Spain, it will be remembered, was the greatest source of precious metals in ancient times, and the Spaniards had no sooner discovered America than they began to look for gold and silver there. They started mining on the Isthmus, at Darien, about 1514. Oviedo, who wrote in 1526, said that he had been for twelve years "surveyor of the melting shops pertaining to the gold mines of the main land."

At first, the king's share was one-fifth, but in 1526 it was temporarily reduced to one-tenth of the products of the mine, and by successive re-enactments this continued to be the royal tithe. At the same time mining was made open to both Spaniards and natives, and attempts, though not always successful ones, were made to protect the natives. Slaves were early introduced, and formed a distinct class from the Indians themselves.

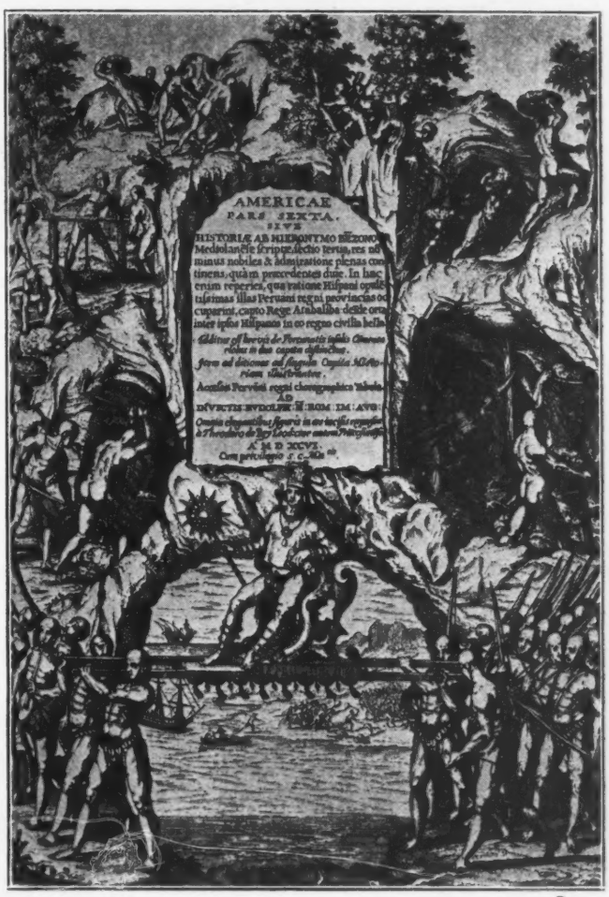
Oviedo wrote that in mining on land, the dirt was carried from the mine in trays to the stream where it was delivered to washers. These were for the most part Indian women, who were wont "to sit by the water's edge with their legs in the water even up to the knees," and thus pan the pay dirt.

But more important than the gold mines discovered by the Spaniards in Central America, Mexico, and Peru, were those of silver. Even before the discovery of America, the Incas made the mines at Porco produce large quantities of silver. A tremendous impetus to silver mining was given by the discovery of silver at Potosi, Peru, in 1545.

The story is that this came about as follows: A

*The fourth and last of a series of articles. The first, second and third articles of the series were published in the issues of Sept. 2, Sept. 9, and Sept. 16, respectively.

*Indians smelting with blowpipes, from Benzoni*




*Mining in America, from title page of De Bry*

*Spaniards forcing Indians to mine for them*

Peruvian by the name of Gualpa, who worked in the mines of Porco, went hunting one day, and it chanced that the game ran up the steep mountain of Potosi. He attempted to follow it by taking hold of one scrub after another, but eventually his weight pulled a bramble, called *quinua*, out by the roots. It seemed very heavy, and looking down he saw a great lump of silver hanging to it. Examining the hole he discovered a large vein of silver ore, which upon being smelted at his home he found to be of the highest grade he had ever known. He worked his mine secretly for some time, but at last his evidently increasing wealth excited the suspicion of his neighbor, Guanca, who forced him to disclose the secret, and started working a near-by vein. As the metal did not come from this so easily, Guanca told his Spanish master, Vilaroel, who in turn registered the mine, and, in accordance with the mining law, obtained several rods to work for himself.

The best description of sixteenth century mining in America is given by Acosta, who after spending a number of years in Peru, returned to Spain in 1587, and in 1590 wrote in Spanish his "Natural and Moral History of the Indies."

According to Acosta, the most famous gold was that of Carovaya, in Peru, and Valdivia, in Chile. An idea of the quantity of gold produced may be gathered from his statement:

"In the fleet in which I came to Spain, which was in the year 1585, the declaration of the mainland was twelve cassons or chests of gold, every casson weighing at least four *arrobas*, that is a hundred weight, and 1,056 marks from New Spain which was for the king only, besides that which came registered for merchants and private men, and much that came unregistered."

*Incas smelting and casting*

Since the mines of Potosi were of such tremendous importance, Acosta paused to give quite a description of them, from which we may abstract the following account:

The rock of Potosi contained four principal veins running north and south, besides various lesser veins running from the main lodes like branches on a tree. By 1585 the mines were deep for that period. In one vein at Potosi were reckoned seventy-eight mines which were 100 fathoms deep, antl a few which were 200 fathoms. In another vein were twenty-four shafts, some from 70 to 80 fathoms deep. To facilitate working at this depth, the Spaniards constructed tunnels called *socavones*, which were begun at the foot of the mountain, and ran horizontally to meet the vein. These were a fathom in height and

eight feet in width. One of these tunnels was begun in 1556, and required twenty-nine years to construct. In 1585 this was driven 3,500 ft. into the mountain, and met the mine shaft 135 fathoms below the top. There were already nine tunnels completed and others begun.

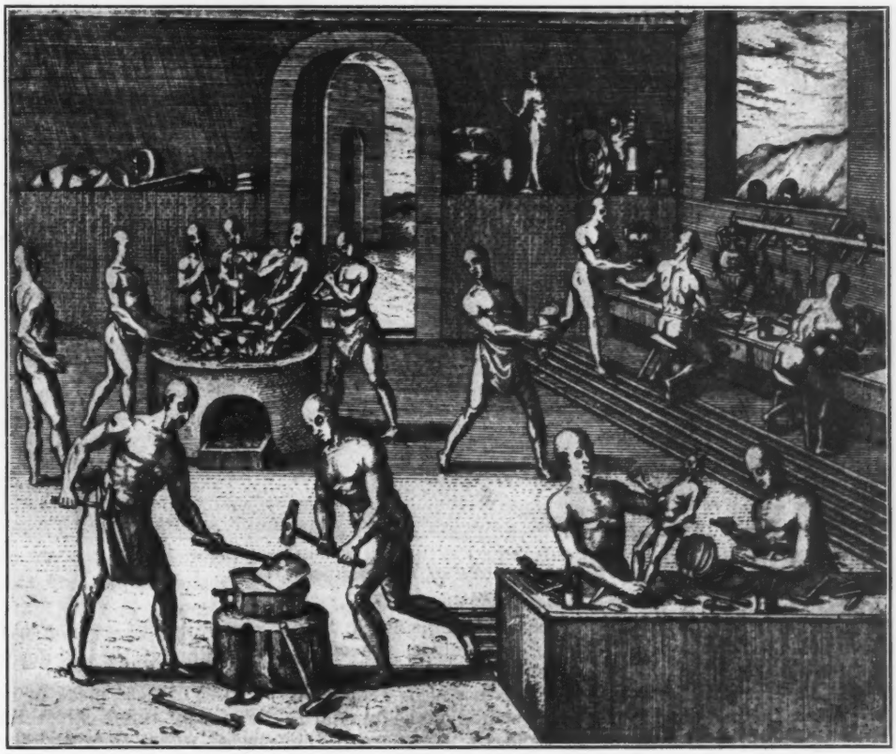
Acosta's description of the work in the mine is too vivid not to be quoted:

"They labor in these mines in continual darkness and obscurity, without knowledge of day or night. And forasmuch as those places are never visited with the sun, there is not only a continual darkness, but also an extreme cold, with so foul an air contrary to the disposition of man, that such as newly enter are sick as they are at sea. The which happened to me in one of these mines, where I felt a pain at the heart, and heating of the stomach. Those that labor therein use candles to light them, dividing their work in such sort, as they that work in the day rest by the night, and so they change. The metal is commonly hard, and therefore they break it with hammers; splitting and hewing it by force as if they were flints. Afterwards they carry up this metal upon their shoulders, by ladders of three branches made of neats leather twisted like pieces of wood, which are crossed with staves of wood, so that by every one of these ladders they mount and descend together. They are ten *estados* long apiece, and at the end of one, begins another of the same length, every ladder beginning and ending at platforms of wood, where are seats to rest them like unto galleries, for that there are many of these ladders to mount by, one at the end of another. A man carries ordinarily the weight of two *arrobas* of metal upon his shoulders, tied together in a cloth in manner of a skippe, and so mount they three and three. He that goes before carries a candle tied to his thumb, for, as it is said, they have no light from heaven, and so they go up the ladder holding it with both their hands; to mount so great a height which commonly is above 150 *estados*—a fearful thing which breeds an amazement to think upon it, so great is the desire of silver, that for the gain thereof men endure any pains."

*Llamas carrying silver bars, sixteenth century*

Acosta also gives an interesting account of the earliest known American smelting. He says the Indian method was by dissolving the metal by fire. "To this end," says Acosta, "they built small furnaces where the wind commonly blew, and with wood and coal made their refining, the which furnaces in Peru they called *huayras*."

The Spaniards had at first also used such *huayras*, which were best for refining the richest ores. Later they learned to use the process of amalgamation with



*Incas smelting and forging, from De Bry*

quicksilver. The method there employed is described by Acosta as follows:

"They first beat and grind the metal very small, with the hammers of the machinery, which beat this stone like unto tan milles, and being well beaten they 'searce' it in a copper 'searce,' making the pouder as small and fine as if it were horse hair; these 'searces' being well fitted, do sift 30 quintals in a day and a night; then they put the pouder of the metal into the vessels upon furnaces, whereas they anoint it and mortify it with brine, putting to every 50 quintals of pouder, 5 quintals of salt. And this they do for that the salt separates the earth and filth, to the end the quicksilver may the more easily draw the silver unto it. Afterwards they put quicksilver into a piece of holland and press it out upon the metal, which goes forth like a dew, always turning and stirring the metal, to the end it may be well incorporated.

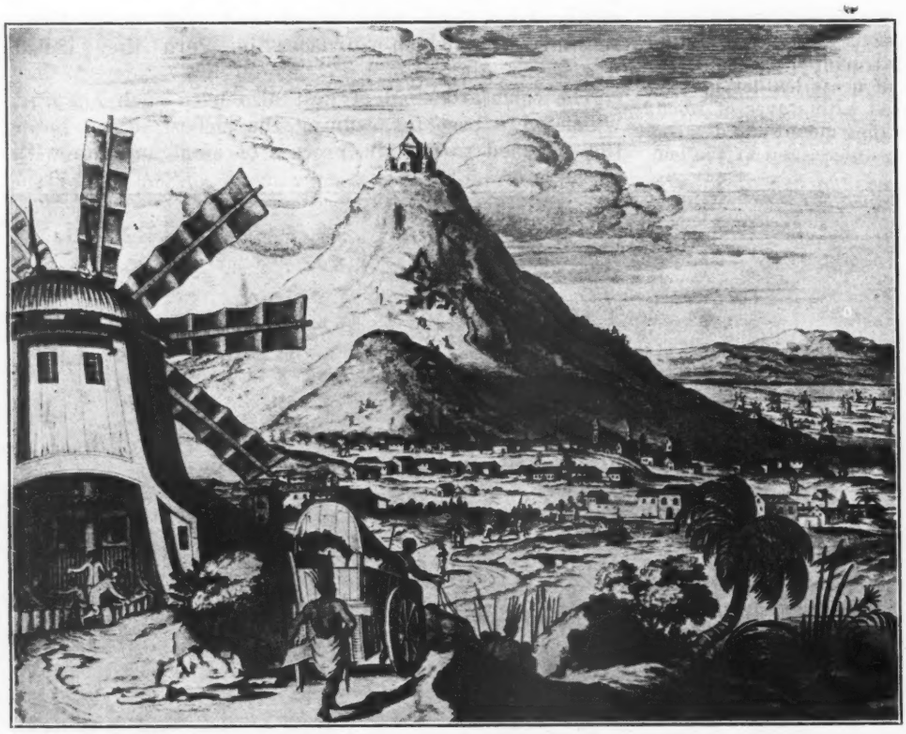
"Before the invention of these furnaces of fire, they did often mingle their metal with quicksilver in great troughes, letting it settle some days, and did then mix it and stir it again, until they thought all the quicksilver were well incorporate with the silver, the which continued twenty days and more, and at the least nine days.

"Since they discovered, as the desire to get is diligent, that to shorten the time fire did much help, to incorporate silver the sooner with quicksilver, they invented these furnaces, whereon they set vessels to put in their metal with salt and quicksilver, and underneath they put fire by little and little in furnaces made for the nonce underneath; so that in five or six days the quicksilver is incorporate with the silver.

"And when they find that the mercury hath done his part, and assembled all the silver, leaving nothing behind, but is well imbrued, as a sponge doth water, dividing it from the earth, lead, and copper, with which it is engendered, then they separate it likewise from the quicksilver, the which they do in this sort; they put the metal in caldrons, and vessels full of water, where with certain wheels they turn the metal round about, as if they should make mustard, and so the earth and dross go from the metal with the water that runs away. The silver and quicksilver as most ponderous remaining in the bottom, the metal which remains is like unto sand. Then they take it out and wash it again in great platters of wood, or keelers full of water, still drawing the earth from it, until they leave the silver and quicksilver well clensed. There slips away also some small portion of silver and quicksilver with the earth and dross, which they call washings, the which they wash again and draw out the remainder.

"When the silver and quicksilver are clensed and begin to shine, and that there remains no earth, they put all the metal into a cloth, which they strain out very forcibly, so that all the quicksilver passeth out, being not incorporate with the silver, like to a mark of almonds pressed to draw oyle. And being thus pressed the remainder contains but the sixth part in silver, and five in mercury. So if there remains a mark of threescore pounds, ten are of silver, and fifty of mercury. Of these marks they make *pinas*, as they call them, like pine apples or sugar loaves, hollow within, which they commonly make of a hundred pound weight.

"Then to separate the silver from the quicksilver, they put it into a violent fire which they cover with an earthen vessel, like to the mold of a sugar loaf, or unto a capuchon or hood, the which they cover with coals, and set fire unto it; whereby the quicksilver exhales the smoke, which striking against the capuchon of earth, thickens and distills, like unto the smoke of a pot covered; and by a pipe, like unto a limbecke, they receive the quicksilver which distills, the silver remaining without changing the form, but in weight it is diminished five parts of that it was, and is spungious, the which is worthy of observation. Of two of these loaves they make one barre of silver, in weight 65 or 66 marks; and in this form they carry it to the touch, custom, and mark. Silver drawn with mercury is so fine, that it never abates of two thousand three hundred and fourscore of alloy."



*Potosi and one of its smelters*

Both stamp mills and grinding mills were used at Potosi, and they were driven by either horsepower or waterpower. It rained only during the winter there, and the rain had to be stored in reservoirs for use in the summer months. If necessary, however, the ore could be carried three or four leagues to Tarapaya, where power was furnished by a river.

The use of quicksilver in smelting was of course not known to the Incas, but they did have mines of vermilion, from which they made paint for decorating themselves. A Portuguese named Henrique Garces, who had known of vermilion in Castile, suspected this to be the same as that from which mercury was extracted, and upon examining the mine, found this to be the fact.

The application of quicksilver to smelting in Peru was credited to Fernando de Velasco in 1571. Its success naturally led to a great demand for quicksilver. The smelting of this is described by Acosta as follows:

"Let us now speak of how they draw out quicksilver, and how they refine silver therewith. They take the stone or metal where they find the quicksilver, which they put into the fire in pots of earth well luted, being well beaten, so that this metal or stone coming to melt by the heat of the fire, the quicksilver separates itself, and goes forth in exhala-

tion, and sometimes even with the smoke of the fire, until it encounters some body where it stays and congeals, and if it pass up higher, without meeting of any hard substance, it mounts up until it be cold, and then, congealed, it falls down again. When the melting is finished, they unstop the pots and draw forth the metal, sometimes staying until it be very cold, for if there remained any fume or vapor, which should encounter them that unstopped the pots, they were

*Interior of silver mine in Peru, sixteenth century*

in danger of death, or to be benumbed of their limbs, or at least to loose their teeth."

## Manufacture of Hollow Drill Steel

An iron bar with a hole through the center is stronger than a solid bar of the same diameter. According to the *Queensland Government Mining Journal* "a British firm has developed a very ingenious process of making what it calls a hollow-cored bar with this increase of strength. The hollow core is really a small hole which extends from end to end of the bar. Obviously it would be a very costly business to bore a hole through the bar, and in consequence this firm has developed a clever way of making the bar hollow without drilling. The mass of metal from which the bar is drawn is drilled in the first case, and the hole is packed tight with a special composition. The ends of the hole are subsequently sealed by a patented process of welding. When the piece of metal is rolled in the mill into a long bar the packing stretches with the metal and preserves the continuity of the hole. One of the most important applications of this hollow-cored bar is for mining drills where the hole is used for a current of air or a jet of water.

In the United States, hollow drill steel is commonly made by drilling a hole, say 1¾ in. in diameter, in a steel billet about 18 in. long by 5 in. in diameter. This hole is then packed with sand and the ends are plugged with steel plugs before the billet is drawn down to the required size. In some special steels, a mandrel with a manganese steel tip is used, followed by hot punching to secure a more uniform hole.

## Exports of Chilean Nitrate Have Improved

The outlook for Chilean nitrate now bears an entirely different aspect from that presented during the past two years. Stocks in Europe and the United States have diminished to a point where they are less than those normally carried, according to *Commerce Reports* for September. The unsold stocks belonging to the members of the "pool" as of July 22 were said to have amounted to 138,768 metric tons. The firm price of cotton in the United States appears to promise a good demand from that source, while the European agriculturists, who were able to absorb the large stocks held by the "pool" at comparatively high prices despite unfavorable conditions, will apparently increase their consumption at the new scale of prices effective for the coming agricultural year. The merits of Chilean nitrate as a fertilizer are apparently still recognized in spite of the encroachments of competing products. It therefore seems reasonable to forecast a demand for Chilean nitrate sufficient to go far toward lifting the industry from its recent depression and make a beginning toward a new era of trade in the commodity. The statistics of nitrate exports are encouraging. During July they amounted to 100,000 metric tons, while during the first seven months of this year the total shipped was 400,000 metric tons.

The total sales of the Nitrate Producers' Association at the new prices, effective July 1, have amounted to slightly over 500,000 metric tons. The association fixed the maximum of 80,000 metric tons for sale during the first half of August, and of the amount allotted for the balance of the month about 30,000 tons remain to be disposed of. The purchasers of nitrate for July and August delivery have not made shipment of their entire commitments, but are expected to await foreign demand and move the balances as required. Independent nitrate, or that produced outside of the association, is, according to the authority quoted, practically unavailable.

According to recent reports, the producers who have not put their plants in operation are selling the quotas allotted them by the association at 10d. to 1s. per 46 kg. (1 Spanish quintal), the purchasers thus obtaining the privilege of increasing their own production by amounts acquired. The total stocks available in Chile as of June 30, 1922, were reported at 1,607,000 metric tons. Exports for the first six months of 1922 amounted to 283,383 metric tons, as compared with 782,000 tons during the corresponding period of 1921, 1,529,500 tons in 1920, and 237,820 tons in 1919. During the first half of 1922, 425,040 metric tons was produced, as compared with 852,000 tons produced in the corresponding period of 1921.

# Market Value of Ores from Mexico

## The Net Return to the Miner on Shipments to the Smelter Is Only a Small Proportion of the Market Value of the Contained Metal — This Article Gives Typical Schedules of Settlement

BY S. F. SHAW

THE MARKETING of ore, when it is shipped to a smelter or other reduction works for treatment, is of much interest to the operator, and only close study of the charges and payments will enable him to determine beforehand the actual value of his ore. Smelter schedules are complicated, and argument has been advanced that they ought to be simplified; but as these schedules are built on a scientific basis, it is in order for the operator to make a careful study of them.

An analysis of settlements according to typical smelter schedules for four different classes of ore will bring out many points of interest. The discussion deals with ores produced in Mexico. Take up first a schedule covering copper ore assaying as follows:

| Ag, g. | Cu, Per Cent | Fe, Per Cent | CaO, Per Cent | Insol., Per Cent |
|---|---|---|---|---|
| 25 | 4.5 | 10 | 15 | 20 |

A typical schedule covering this class of ore would be about as follows:

| | |
|---|---|
| Payments | |
| Silver | If 50 g. contained, pay for 95 per cent at New York quotations. |
| Copper | If less than 5 per cent, deduct 5 kg. and pay for the balance at New York quotations for copper, less 3c. per pound or 6.61c. per kg. for freight, refining, and selling; if more than 5 per cent contained, pay for 90 per cent at New York quotations, less 3c. per pound. |
| Iron | Pay for all at 5c. per unit. |
| Lime | If 3 per cent contained, pay for available lime at 5c. per unit. |

In the following computations, payments for iron and lime and deductions for insoluble will be considered as payments and deductions respectively from the treatment rate. Assuming a price of 13c. per pound for copper, settlement on ore of the grade noted would be as follows:

| | | | | |
|---|---|---|---|---|
| Deductions | | | | |
| Treatment | f.o.b. smelter, $2.50 U.S. currency, per metric ton. (2,204.6 lb.) | | | |
| Insoluble | Charge for all at 10c. per unit contained. | | | |
| Taxes | For account of the mine. | | | |
| Payments | | Per Ton Ore | Per Lb. Copper | |
| 4.5 per cent copper, 45 kg. or 99.2 lb. | | $12.90 | $0.1300 | |
| Less deduction of 5 kg. | | 1.43 | 0.0144 | |
| Less 3c. per lb. for refining, etc. | | 2.65 | 0.0267 | |
| Payment for copper contained | | $8.82 | $0.0889 | |
| Deductions | | | | |
| Treatment | | $2.50 | | |
| Add insoluble, .10 x 20 | | 2.00 | | |
| | | $4.50 | | |
| Deduct iron, 10 x .05 | .50 | | | |
| Deduct lime, 15 x .05 | .75 | | | |
| | | 1.25 | | |
| | | 3.25 | .0327 | |
| Federal taxes | | .25 | 0.0025 | |
| Freight to smelter | | 3.60 | 0.0363 | |
| Total deductions | | $7.10 | $0.0715 | |
| Net to the mine, f.o.b. shipping station | | 1.72 | 0.0164 | |

In other words, after paying the freight, smelter charges, smelter deductions and refining, the miner receives $1.72 per ton or 1.64c. per lb. for ore of which the total copper content in a refined condition would be worth $12.90 per ton or 13c. per lb. metal. The percentage of the total copper value received by the miner is therefore 12.6. This type and grade of ore obviously will not pay mining expense if shipped; therefore it should be concentrated at the mine if possible; this would result in a lower freight rate and smelting charge per lb. of copper in the crude ore.

Next consider a lead ore, assaying as follows:

| Ag, g. | Pb, Per Cent | Fe, Per Cent | CaO, Per Cent | Insol, Per Cent | S, Per Cent |
|---|---|---|---|---|---|
| 25 | 40 | 20 | 10 | 12 | 1 |

The following smelter schedule will apply to this ore:

| | |
|---|---|
| Payments | |
| Silver | If 50 g. contained, pay for 95 per cent of contents at New York quotations. |
| Lead | If 50 per cent dry assay (wet assay less two units), contained, pay for 90 per cent of contents at $3 U. S. currency per 100 kg. when the price of lead in New York is quoted at $4.25 per 100 lb., with addition or deduction of $1.50 per 100 kg. for each variation of $1 above or below $4.25 per 100 lb.; fractions in same proportion. |
| Iron | Pay for all at 5c. per unit. |
| Lime | If 3 per cent contained, pay for available lime at 5c. per unit. |
| Deductions | |
| Treatment | f.o.b. smelter, $5.50 U. S. currency per metric ton, with deduction of 12.5c. per unit of lead for each unit in excess of 5 per cent dry assay. |
| Insoluble | Charge for all at 10c. per unit. |
| Sulphur | 1 per cent free; excess at 25c. per unit: maximum charge $3 per ton. |
| | Credits for iron and lime, and charge for insoluble will be considered as a part of the treatment rate. |

Assuming that lead is selling in New York at $5.50 per 100 lb., the payments will be as follows:

| | | | Per Ton Ore | Cents Per Lb. Lead |
|---|---|---|---|---|
| Payments | | | | |
| Gross value, 40 per cent, 400 kg. or 882 lb. | | | $48.51 | $0.0550 |
| Deduction 2 per cent for dry assay | | | 0.97 | 0.0011 |
| Deduction 10 per cent (3.8 units) 38 kg. | | | 4.61 | 0.0052 |
| Deduction for freight, refining, etc. | | | 26.26 | 0.0298 |
| Payment for lead contained | | | $16.67 | $0.0189 |
| Deductions | | | | |
| Treatment per ton | $5.50 | | | |
| Add for 12 per cent insoluble at 10c. | 1.20 | | | |
| | | $6.70 | | |
| Deduct iron, 20 per cent x 0.05 | $1.00 | | | |
| Deduct lime, 10 per cent at 0.05 | .50 | | | |
| Deduct for 33 units lead | 4.12 | | | |
| | | 5.62 | | |
| Deductions | | $1.08 | 1.08 | 0.0062 |
| Freight | | | 3.20 | 0.0014 |
| Total deductions | | | $4.28 | $0.0083 |
| Net value, to the mine, f.o.b. railroad | | | 12.39 | 0.0141 |

The net value to the shipper at the mine railroad station is therefore $12.39 per metric ton, or 1.41c. per lb. of lead when the New York quotation is 5.5c. per lb. There is no payment for silver when the ore contains less than 50g. per metric ton. It is seen that the smelter losses, refining charges, etc., account for 3.60c. per lb. and smelter charges and freight make up 0.48c. per lb. The charge for smelting in this case is not high, providing, of course, that deductions for slag losses and for refining do not disguise a heavy charge. The percentage of the total lead value received by the shipper is 25.6 per cent.

Next consider the returns from a lime-fluxing silver ore containing the following:

| Ag, g. | Fe, Per Cent | CaO, Per Cent | Insoluble, Per Cent |
|---|---|---|---|
| 650 | 2 | 40 | 8 |

A smelter schedule covering settlements on this ore would be about as follows:

| | |
|---|---|
| Payments | |
| Silver | If 50g. contained, pay for 95 per cent at New York quotations. |
| Iron | No payment. |
| Lime | If 3 per cent contained, pay for available lime at 8c. per unit. |
| Deductions | |
| Treatment | f.o.b. smelter, $4.50 U. S. currency per metric ton. |
| Insoluble | Charge for all at 10c. per unit. |
| Taxes | All for account of the mine. |
| Freight | For account of the mine. |

| Payments | Per Ton Ore | Per Oz. Silver |
|---|---|---|
| Silver, 650 g. or 20.28 oz. | $14.20 | $0.7000 |
| Deduction 5 per cent | .71 | 0.0350 |
| Net payment for silver | $13.49 | $0.6650 |

| | | | |
|---|---|---|---|
| Deductions | | | |
| Treatment | $4.50 | | |
| Add for insoluble, 8 x 0.10 | .80 | | |
| | $5.30 | | |
| Deduct for lime, 40 x 0.08 | 3.20 | | |
| | | $2.10 | $0.1035 |
| Federal tax | | 0.94 | 0.0463 |
| Freight | | 4.20 | 0.2071 |
| Total deductions | | $7.24 | 0.3569 |
| Net value to the mine, f.o.b. railroad | | 6.25 | 0.3081 |

The gross value of the silver in the ore, with no losses, deductions, etc., is $14.20 per metric ton; the net to the mine is $6.25, or 44 per cent of the total value of the silver in the ore.

Zinc ore from Mexico has been marketed on the following basis, f.o.b. nearest United States port of entry:

| | |
|---|---|
| Base price | $16 U. S. Currency per metric ton for ore assaying 40 per cent zinc, when zinc is selling in St. Louis at $5 per 100 lb. |
| Assay variation | Add or deduct $1.10 U. S. Currency per unit for each unit above or below 40 per cent zinc. |
| Price variation | Pay for 65 per cent of the increase in price of zinc between $5 and $6 per 100 lb.<br>Pay for 50 per cent of the increase in price of zinc between $6 and $12 per 100 lb.<br>Pay for 25 per cent of the increase in price of zinc when selling at more than $12 per 100 lb. |

With zinc selling at 6c. per lb., settlements on shipments from one point in Mexico to the United States under terms of the above schedule would be approximately as follows:

| Payments | Per Ton Ore | Per Pound Zinc |
|---|---|---|
| Total value, 38 per cent or 838 lb. at 6c. | $50.28 | $0.0600 |
| Freight, border port to smelter | 3.85 | 0.0046 |
| United States duties | 2.34 | 0.0028 |
| Smelter losses, cost of smelting, freight on zinc, commission | 24.84 | 0.0297 |
| Deductions in United States | $31.03 | $0.0371 |
| Payment, f.o.b. border port | 19.25 | 0.0229 |
| Deductions | | |
| Freight to border | $8.09 | $0.0097 |
| Mexican export duties | .84 | 0.0010 |
| Border charges, commission | .90 | 0.0011 |
| Total deductions | $9.83 | $0.0111 |
| Net to shipper, f.o.b. railroad | 9.42 | 0.0118 |

It is noted that the mine receives $9.42 per ton for an ore containing 38 per cent zinc, which compares with a total gross value of $50.28 for the total contents, leaving the mine with 18.8 per cent of the gross value of the zinc in the ore. Cost of smelting, losses in smelting and smelter profits absorb 2.97c. per lb., or practically 50 per cent of the value of the zinc. Total freight absorbs 1.43c. per lb., duties 0.38c. per lb., and border charges 0.11c. per lb.

It is evident that the miner must figure carefully on the marketing of his ore if he is to win a profit from operations. The distance which the ore must be transported to the smelter is a vitally important factor. It will be noted that the amount absorbed by transportation in the above examples is 28 per cent, 6.5 per cent, 29.6 per cent, and 24 per cent respectively, which varies, of course, with the location, grade of ore, and like factors. Smelter treatment charges amount to 25 per cent, 2.2 per cent, and 14.8 per cent, respectively for copper, lead, and silver ore, though the amount concealed under the head of smelter losses, etc., may bring this up to a larger proportion.

## Zinc-Dust Precipitation at the Modder "B" Plant in South Africa

The precipitation of gold from cyanide solutions by zinc dust at the Modder "B" dates from 1911, when milling operations first started. A paper by S. Newton and L. L. Fewster, published in the *Journal of the Chemical, Metallurgical and Mining Society of South Africa* (Johannesburg; price 3s. 6d.) describes the practice at that plant before and after the introduction of de-aëration of solution.

Several types of zinc feeders have been used, the first being the belt type, which was discarded on account of irregular feeding owing to belt slippage. The present type employs a leather belt for carrying the zinc dust, the edges of the belt being punched with ⅜-in. holes pitched to mesh over sprockets on the head and tail pulleys, the belt being driven by chain and gears.

When the zinc-dust process was first commenced at Modder "B," the precipitate from the presses was acid treated, briquetted, scorified, and cupelled, but this method not being a success, it was discontinued in favor of acid treatment, calcining, and pot smelting, which in turn gave way to acid treatment, Tavener furnace smelting, and cupelling. At present, the precipitate is smelted in the Tavener furnace without acid treatment. This is because of the decreased consumption of zinc, increased value of precipitate, and smaller amount of precipitate to be treated, since the introduction of the Crowe process.

The many advantages of the Crowe process are described, the only disadvantage being a more slimy and less permeable cake in the press. Experiments have been carried out employing various materials as added filtering mediums, such as ground coke, sawdust, and kieselguhr, in order to obtain a more porous cake. So far, kieselguhr appears to be the most satisfactory.

## Electric Mine Lamps Require Safety Devices Says Bureau

In view of frequent expressions of doubt as to the necessity for a safety device on portable electric miners' lamps, designed for use in explosive mine atmospheres, which would be effective in opening the bulb circuit whenever the bulb was broken, the U. S. Bureau of Mines recently conducted, at the Pittsburgh experiment station, a series of tests with bulbs such as are being used today on miners' lamps energized with 2-v. lead cells. The results of the tests afford the most convincing argument as to the necessity of an adequate current-interrupting safety device on miners' electric lamps. In fifty-five tests in which the naked filament was exposed, either at the beginning or after smashing the bulb, fifty-one ignitions resulted. These ignitions were all obtained with normal voltage impressed on the bulb filament. Fifteen successive ignitions on one filament showed the toughness of the filament, and how easy it is to get an explosion before the filament is burned through. The twenty smash tests in which sixteen ignitions were obtained show that in the majority of cases the filament is in condition to cause ignition after the bulb glass has been broken. Though a time lag in the ignition of gaseous mixture is admitted, these tests show that the time lag of the filaments burning through is greater, and consequently can by no means be relied on as a protection against gas ignition. The Bureau of Mines feels that its policy of requiring a safety device on electric miners' lamps is both wise and necessary. The Bureau recommends to the user of portable electric lamps more attention to the careful maintenance of the safety devices of such lamps, and discourages the use of any modifications that interfere in any way with their proper operation. Details of these tests are given in Serial 2,371, just issued, "Why Miners' Portable Electric Lamps Require Safety Devices."

# USEFUL OPERATING IDEAS

## Taking a Solar Observation

BY STRAUSS L. LLOYD

I have been interested for many years in what is generally known as the direct solar observation, and have been on the lookout for new ideas and methods on this subject and the many methods for the determination of the true meridian.

A great many engineers simply look at the sun and estimate the time or the altitude itself, which, with simple tables, gives the time within a few minutes, no watch being required, for as a matter of fact, half an hour in the time does not, as a rule, affect the result, as the greatest change in declination is less than one minute of arc per hour.

Long ago I discarded the method of holding a card behind the eyepiece and have found that all of my friends have done likewise. After centering the sun's image on a card or a piece of white paper for a few minutes, the eyes are so dazzled that an engineer can not recognize even his mother-in-law, let alone read a vernier with any comfort. The card is soon given up by most surveyors and the brown back of a note book used to avoid the glare. In either case the eyepiece must be specially focused both before and after the observation, and this with many instruments means that there is danger of moving the whole instrument.

The surveyor should never move his eyepiece except to clean or adjust it. There is no need to change the focus of the eyepiece if in place of the card a piece of colored glass is set in the sliding cover. It is there always ready for use and simply serves as a part of the cover. When the sun is too high to use such an eyepiece, accurate results as a rule cannot be obtained in the United States. An engineer should start early enough, or stay late enough in the field, to get the sun with an ordinary transit. A prismatic eye is useful at times, but the instrument is also liable to be jarred in taking it on or off. As a matter of fact, the prismatic eyepiece, when most wanted, is usually found to be absent.

If the transit has been leveled with the telescope level vial, and usually even when it has not, correct results may be obtained by observing the telescope normal and then inverted, even with an instrument not in adjustment and not perfectly level. The average of two readings with the telescope normal and inverted is taken. Slight discrepancies in level do not affect the result. Though perhaps the best results cannot be obtained by dividing the sun into quadrants, certainly sufficiently good results can be had, and this method is usually preferred. It is accurate at all times of the year to one minute of arc where several observations are made. It is certainly less confusing, especially for the beginner, than to add or subtract a semidiameter.

Though a great deal can be said about the instrumental work connected with the direct observation, it is a matter of opinion and subject to changes under varying conditions of work; but there does seem to be a wide difference of opinion in regard to the formulas used. Chauvenet says[1]:

"Case V. Given the three sides, or $a$, $b$, and $c$ . . . We have three methods for computing the half angles:

1. By the sines. . . . Remembering that

$$s = \tfrac{1}{2}(a + b + c)$$

$$\text{Sin } \tfrac{1}{2} A = \sqrt{\frac{\sin (s-b) \sin (s-c)}{\sin b \sin c}} \qquad (164)$$

2. By the cosines,

$$\cos \tfrac{1}{2} A = \sqrt{\frac{\sin s \sin (s-a)}{\sin b \sin c}} \qquad (165)$$

3. By the tangents,

$$\text{Tangent } \tfrac{1}{2} A = \sqrt{\frac{\sin (s-b) \sin (s-c)}{\sin s \sin (s-a)}} \qquad (166)$$

"When only one of the angles is required, the simplest method will be by formula 165, but if the required angle is less than 90 deg., it will be found more accurately by formula 164, for then $\frac{1}{2}$ A $<$45 deg., and the sine varies more rapidly than the cosine. And, for a similar reason, if the angle is greater than 90 deg., we should prefer formula 165. By formula 166 we always have an accurate result, although the formula is not quite so simple."

But, whatever formula is taken, they are all out of date, and have been superseded among all working mining engineers by McElroy's formula. My associates and I have found after years of experience and experiment in actual work, that every one, especially the beginner, is sure to make mistakes in using the old formulas above quoted. Although people should not make mistakes, they certainly do, especially where results have to be worked out on the ground. It is found that 90 per cent of the mistakes are made in finding $s$ and in subtracting from $s$ and also subtracting for colatitude, coaltitude, and codeclination. Besides this, it takes twice as long to use one of the old formulas as to use the new one.

McElroy's formula is as follows:

$$\text{Cos } Z = \frac{\sin d}{\cos 1 \cos a} - \tan 1 \tan a$$

With respect to the signs of this formula, the engineer has simply to remember that the first term of the second number is plus for north declinations, minus for south declinations, and that the second term is minus for north latitudes and plus for south latitudes.

It will be seen at once that there are no confusing subtractions to get coaltitude, colatitude, and the like. The declination is looked up once and for all when many observations are taken at the same time. The cosine and tangent of latitude, respectively, are on the same line in the table, and a set of observations will be all on the same page or adjoining pages. There is no confusion when the sun is north or south. Where the engineer is working for some length of time in the same place he can easily prepare a table showing the cosine

[1] "A Treatise on Plane and Spherical Trigonometry," Ninth Edition, p. 203.

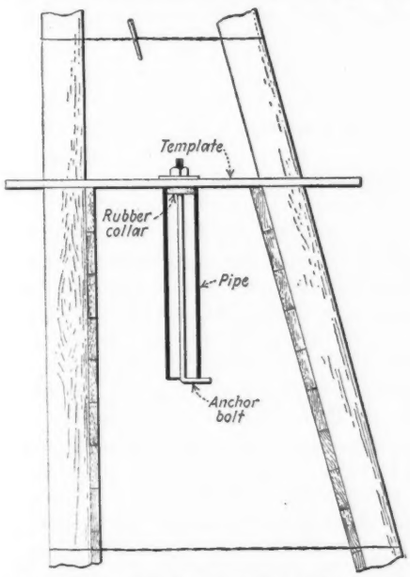
and tangent of latitude, and thus avoid looking them up in a larger table each time. In fact, when an engineer knows within a few hours of time where he is going to make his observations, as is often the case, he can figure out the declination in advance and set down the night before all the figuring except the altitude.

## Setting Anchor Bolts in Concrete Work

BY C. N. SCHUETTE

Anchor bolts for concrete foundations are generally hung from templates placed on the form and are surrounded by a pipe of larger diameter to permit of such slight adjustment in the position of the anchor bolts as may be necessary. The anchor bolts should be in the center of the pipe to permit adjustment in all directions, but in practice it is difficult to ensure this, owing to tamping, which may throw the pipe against the bolt.

The method illustrated in the cut was designed to overcome this difficulty. A collar of gasket rubber, cut to fit into the pipe, is tacked to the under side of the template around the bolt hole. The bolt and pipe are then placed in position, the pipe being held against the template either by the anchor bolt itself or by a wire from the bottom of the pipe to the template. The rubber collar ensures the accurate centering of the anchor bolts.



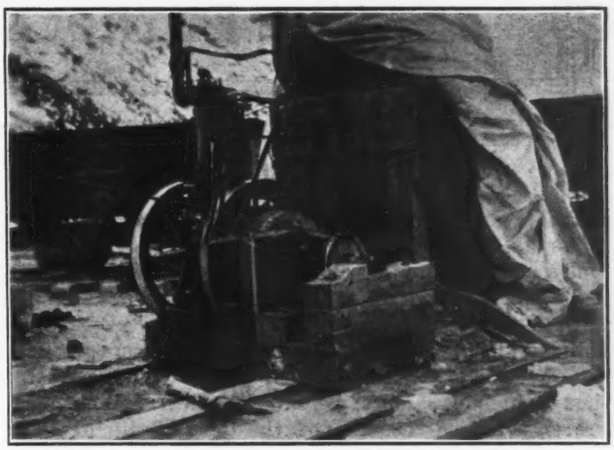

*Rubber collar holds bolt in center of pipe*

## A Novel Hoisting Engine

BY N. P. PETERSON

For operating a small aërial tramway used for hoisting timber it was necessary to have a drive sheave that could be made to run in either direction, as the grade of the track cable was not enough to return the car to the bottom by gravity. The device described here was assembled from parts taken from a discarded Ford car.

A flange coupling, like that at the end of a Ford crank shaft, was made and keyed to one end of the crank shaft of a 5-hp. Fairbanks-Morse gasoline engine. To this was bolted a Ford flywheel and transmission from which the magneto and clutch mechanism had been removed. In place of the universal joint a piece of shafting was attached, on which a 10-in. sheave wheel was keyed. A Ford oil pan was cut so as to leave only the part that incases the transmission and flywheel; the hole left, where the crank case was cut off, was covered by an iron plate, which was bolted on. The upper half of the case needed no alteration. The low gear, reverse, and brake pedals were cut off and levers welded on in their places.



*Gasoline hoist with drive sheave made of Ford parts.*

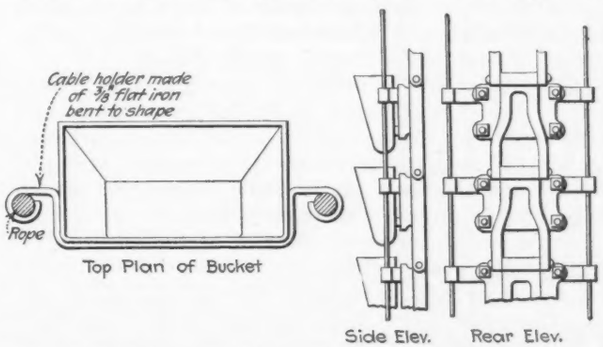
The car is pulled up with the low gear and down with the reverse gear, and travels about 250 ft. per minute.

## Chain-and-Bucket Elevator Device

BY A. W. ALLEN

At a mine in South America the ore is crushed in a primary breaker, then raised by chain-and-bucket elevator to a screening and sorting plant. Much trouble, delay, and expense occurred in consequence of the occasional breakage of a link in the chain, followed immediately by the collapse to the ground of the entire conveyor. It was decided that the most desirable plan would be to hold the several buckets together by two steel cables. For the purpose an eyelet lug was made and bolted to the sides of the buckets. The cables were passed through the eyelets and spliced, thus preventing the buckets from falling in the event of breakage. Some trouble resulted, due to the wear on the nuts and threads inside the bucket. It was then decided to adopt the form of cable holder shown in the cut. This consists of a strip of $\frac{3}{8}$-in. flat iron, bent in the shape illustrated.

This device prevented the collapse of the elevator, but it was found that, in the event of an accident, the cable fell on to the top shaft with such force that damage was feared; so an additional refinement was added. Alongside the sprocket wheels on the top shaft were bolted two wooden pulleys, arranged so that the cable had only a small distance to fall in the event of breakage of the bucket links. The combined arrangement is satisfactory, and a considerable saving in time and expense has resulted from its adoption.



# THE PETROLEUM INDUSTRY

## New Albany Oil Shale of Indiana*

THE principal oil shale in Indiana is known as the New Albany shale. It is of Devonian age, and is usually correlated with, although not certainly of the same age as, the Antrim shale of northern Michigan, the Ohio shale of Ohio, and the Chattanooga shale of Kentucky, Tennessee, and Georgia. The normal thickness of the formation in Indiana is about 100 ft., although in the region of its outcrop the full thickness is rarely exposed, because of the general dip of the strata, which is about 30 ft. per mile to the west. With the exception of thin local phases, the entire thickness is oil shale.

The shale is rather hard and brittle when fresh, and may be crushed readily. The surface of freshly broken pieces has a velvety black color. Weathering develops fissility and changes the black color to gray. Weathered outcrops always yield relatively small quantities of oil. The depth to which weathering affects the shale varies with the position of the outcrop, but usually it is not more than four or five feet.

Microscopic examination of thin sections reveals resinous-appearing spores and spore cases and fragments of spores and spore cases. It is believed that the amount of oil obtainable from different samples varies directly with the amount of resinous-appearing bodies.

Most of the sulphur occurs as pyrite and is found in the shale in the form of nodules and lenses, the nodules varying in size from ¼ in. to 2 in. in diameter, and the lenses from very thin filaments up to ½ in. in thickness. There is some evidence that the yield of oil varies directly with the percentage of volatile matter carried by the shale.

The New Albany shale outcrops principally in the southeastern part of Indiana, between North Vernon and New Albany. The outcrop district, running north and south, is about fifty miles long and from five to ten miles wide, and includes about 500 square miles. The same shale is also found outcropping in the northeastern part of the state, along the banks of the Wabash River and its tributaries in White and Carrol counties, in the vicinity of Monticello, Delphi, and Rockfield.

The southeastern or principal outcrop district covers parts of Jennings, Jackson, Scott, Jefferson, Clark, and Floyd counties. The country is for the most part rolling, and is traversed by numerous permanent streams. The average thickness of the shale within the belt of the outcrop is probably about fifty feet.

Distillation of numerous samples of the shale taken from various places within the outcrop belt indicates that the shale will yield from 6 to 14 gal. of oil per ton. These distillation tests were made with the Bureau of Mines standard assay retort. The amount of oil produced from a given sample can be made to vary as much as 8 per cent by varying the rate of retorting. The highest yield of oil is obtained when the retorting time is one hour or slightly more. The oil separates readily from the water produced with it, there being only slight tendency toward the formation of emulsions. The shale does not coke or intumesce in the retort up to temperatures as high as 600 deg. C. At a temperature of 450 deg. C. the production of oil is completed.

The oil produced from thirty-one samples, each of which was retorted in one hour in the Bureau of Mines assay retort, has the following characteristics:

| | |
|---|---|
| Specific gravity at 15.56 deg. C. | 0.931 (20.4 deg. Bé.) |
| Setting point | Below 0 deg. C. |
| Fraction to 275 deg. C., per cent. | 41.5 |
| Unsaturation fraction to 275 deg. C., per cent. | 39.2 |

The oil from the Indiana shale yields a higher percentage of tops (the percentage distilling at atmospheric pressure up to 275 deg. C.) than do the oils from the Western shales, and the percentage of unsaturation also is less than that of the tops from the Western shale oils. The motor-fuel index numbers of three oils are:

| Shale | Index No. |
|---|---|
| Oil from Indiana (New Albany) shale | 29.59 |
| Oil from Colorado (De Beque) shale | 19.36 |
| Oil from Utah (Soldier Summit) shale | 20.35 |

The setting points of the vacuum fractions indicate that the Indiana shale can hardly be considered a source of paraffin wax. The high viscosity and gravity of the vacuum distillates are noteworthy, as is also the high percentage of carbon residue of the vacuum residuum. The crude oil from the Indiana shale is characterized by high specific gravity and low setting point as compared with oils from the Utah and Colorado shales.

The amount and composition of the gas produced from the New Albany shale vary with the rate of retorting and with the final temperature of the shale. Under different retorting conditions the amount of gas obtained varied from 500 to 1,800 cu.ft. per ton of shale, and its net heating value averaged 750 B.t.u. per cubic foot. The percentage of hydrogen sulphide in the gas is unusually large, analyses indicating that it may run as high as 20 per cent.

Analyses of four samples taken from widely separated localities indicate that the potash content (expressed as $K_2O$) of this shale varies from 4.08 to 5.12 per cent. Most of the potash occurs as a silicate and cannot be recovered by leaching, and probably not by any other commercially feasible method. Water-soluble potash ($K_2O$) in the spent shale varies from 0.1 to 0.5 per cent. If the average is 0.25 per cent, the indicated available water-soluble potash would be 5 lb. per ton of spent shale. This figure does not include losses in commercial working. It is very doubtful if this shale should be considered as a commercial source of potash.

Until a market is established for refined products from oil shale, all the comparative aspects of different shales and shale oils will not be known. Data have already been presented that show important differences between the oils produced from the New Albany shale and oils from Western shales. The yield of oil from New Albany shale is much less than the average yield from Western shales, and probably somewhat less than from Kentucky shales.

*Abstract from a paper by John R. Reeves, department of geology, University of Indiana. Distributed by the U. S. Bureau of Mines.

# SOCIETIES, ADDRESSES, AND REPORTS

## A. S. & R. Denies That It Has Not Welfare of Ore Producers at Heart

### Tells of Development of Improvements to Reduce Smelting Costs and Explains Some of the Smelter's Troubles and Responsibilities

IN A statement recently made by William Loeb, Jr., vice-president of the American Smelting & Refining Co., denial is made of articles appearing recently in Western newspapers implying that the Smelting company is little interested in the welfare of ore producers of that region. Says Mr. Loeb:

"That the American Smelting & Refining Co. has done its duty by its stockholders is not *per se* an indication that it has acted detrimentally to the interests of mine operators. The operating policies of the company which have been profitable to its shareholders have also been of benefit to the ore producers with whom the company deals.

"One has but to review the progress made in the treatment of ores, during the past few years, to appreciate how greatly the ore producers have benefited by research, invention, and metallurgical efficiency contributed to the industry by the smelting and refining companies. Ores which, because of their low metallic content, were formerly of no value are now successfully handled by the smelters.

"The more skilled treatment of ore, resulting today from unremitting scientific experiment and research, in which our company has been a pioneer, is reflected in our ability to keep down treatment charges, in spite of increased costs of fuel and labor, and in greater ability to handle low-grade ores."

Then follows mention of some of the improvements effected by the company which are beneficial to the entire industry. Improvements in roasting of lead ores are particularly important, according to the statement. From the early hand roasters, the single-hearth type, such as the Godfrey, was developed, and afterward the multiple-hearth type, such as the Wedge. For blast-furnace smelting, first the H.-H. pots were adopted and experimentally developed by the Smelting company, and then the Dwight machine. In blast-furnace work the chief improvement has been in the substitution of mechanical charge handling for hand labor. Metal losses have been greatly lowered by the use of reverberatory settlers, baghouses, and Cottrell plants. "The practical development of the Cottrell process has been almost entirely due to the activity at the various plants of our own company," says Mr. Loeb.

In copper smelting, the improvements developed by the Smelting company are said to include the adoption of mechanical roasters, larger blast and reverberatory furnaces, and the Peirce-Smith converter, which, under favorable conditions at Tacoma, is producing as high as 150 tons of copper per day. Facts are then adduced to show that increased charges for smelting have been nowhere near so great as the general increase in the price level. The statement continues:

"A fact too often overlooked is that initial production of ore is not the end of the story. When the miner has done his part the metallurgist and the refiner must step in, and the refiner is also banker for the industry. When the producer sells his ore for cash his financing is completed, but with the smelter the financial end of the transaction has just begun. Three or four months may and usually do elapse before the smelter realizes upon the finished product to which the miner contributed the raw material and received his pay.

"Criticism directed at the smelters would indicate that some miners believe we possess a magic method through which we always sell at higher quotations than we pay. But that is not true. There are hazards in our end of the business, which, like any other business, is responsive to the natural law of supply and demand. There are periods when we cannot sell metals at as good a quotation as that paid on the date at which the ore was purchased.

"Market prices for metals are, at times, subject to sudden and sharp variations, which may wipe out an anticipated profit. Ore production is stimulated in times of high prices and smelters' stocks are increased. Experience has shown that the market drops more rapidly than it rises, and the chance of loss on large reserves of metal or even on metal in transit is always present.

"Recent events have demonstrated that at the end of a boom-price period the smelter is left with a lot of material acquired at high prices which must be sold at a loss. And that is a loss to the smelter, not to the miner.

"The business of a large smelting company runs into many millions of dollars a year, but on the amount of the turnover the profits are comparatively small. It is doubtful if there are many other businesses having as large a turnover whose profits are so low on the amount of business transacted. In this connection it will be recalled that the smelter and ore sales investigation showed that the average net profit on smelting Colorado ores for five years—1912 to 1916—was 95c. a ton.

"The smelting business is highly technical and has many problems unknown to persons not directly engaged in it. The proportion of crude ore received at all of our smelters as against the quantity of concentrate grows less each year. It costs more money to handle concentrate than it costs to handle crude ore, and the handling and metallurgical loss is usually greater. The smaller volume of tonnage handled increases overhead costs tremendously. Concentrate has the silica washed out, but silica is necessary to flux the iron, and limerock has to be smelted to flux both. Formerly it was the custom to pay for the iron, because rich siliceous ores predominated, and it was possible to charge the silica man and pay the iron man. Silica, iron, and lime are all necessary in slag formation. All are wasted over the dumps. Thus, each element in any man's ore is worth only what it can be sold for in fluxing its offsetting elements in some other man's ore. It may not be generally realized, but on the types of slag we run from day to day our fluxing costs vary as much as 100 per cent.

"Again, ores are not susceptible of handling on a standardized basis like so many pounds of wool at a spinning mill. Each ore requires a varied treatment, and that is not the last or the least of our troubles.

"As a matter of fact, but one of the two Colorado plants of the American Smelting & Refining Co. can operate upon local lead. The other is obliged to use large quantities of lead ores and concentrates brought from other states. Without this outside supply for purposes of smelter operation the mining industry of Colorado would be greatly handicapped by lack of smelting facilities.

"This fact is another indication that the company is genuinely interested in the welfare of the mining industry. The interests of the company and of ore producers generally are mutual interests. On the company's part these interests are vitalized in the tremendous aggregation of facilities in smelting and refining plants, in technical and business staffs, in laboring organization, in transportation and sale of resultant metals, and in liquid capital which the company has placed at the disposal of the ore producers of the United States. Therefore, to imply that it has little concern for the welfare of miners and is doing nothing to encourage the mining industry is to go contrary to the facts."

## MEN YOU SHOULD KNOW ABOUT

**A. H. Lawrie** is visiting mining districts in the West.

**W. W. Mein** will establish an office in San Francisco.

**A. H. Collbran** sailed for London on Sept. 14. He is expected to return in October.

**Harold Jeans** is expected in San Francisco about Sept. 20, on his way to Japan.

**F. Lynwood Garrison**, of Philadelphia, is engaged in examing mines at Eureka, Nev.

**Frank Reeves**, of the U. S. Geological Survey, has completed his field work in Montana.

**William Watters**, superintendent of the Tonopah Divide Mining Co., is in San Francisco.

**R. G. Hall** is at Winthrop, Calif., making experiments in connection with the Hall process.

**John Dynan**, mine superintendent of the Tonopah Extension, has returned to Tonopah from Seattle.

**Michael Sullivan**, of Spokane, has made several inspections in the Bayonne district, near Sandon, B. C.

**Colonel Alfred H. Brooks** has returned to Washington after having spent the summer in Alaska.

**H. D. Budelman**, mine superintendent of the West End and Halifax companies, has returned to Tonopah from California.

**Harry H. Armstead** and **D. G. McLachlan** have made examinations of several properties in the Lardeau district, B. C.

**George W. Starr**, manager of the Empire mine, at Grass Valley, Calif., is taking a holiday in England, and is now in London.

**Philip S. Smith** has completed geologic surveys along a part of the Alaska Railroad and sailed from Seward for Seattle Sept. 4.

**H. G. Ferguson, S. H. Cathcart** and **J. T. Singewald** have completed their season's field work in Nevada for the U. S. Geological Survey.

**R. B. Moore**, chief mineral technologist of the U. S. Bureau of Mines, is making a tour of the Bureau's experiment stations in the West.

**H. Waern** has returned to Copper Cliff, Ont., as chief chemist at the International Nickel Co.'s smelter. He has been in Norway for several years.

**R. P. Doucet**, who has been for some years general sales manager of the Asbestos Corporation of Canada, Ltd., has recently been appointed general manager.

**C. R. Longwell**, who has been doing work for the U. S. Geological Survey during the summer months, has returned to his University work at New Haven.

**H. L. Harland**, of the Robinson Gold Mining Co., at Johannesburg, S. A., is in San Francisco. He has returned from a visit to the Alaska-Juneau, at Juneau, Alaska.

**David White**, chief geologist of the U. S. Geological Survey, has returned from a trip to Europe, where he represented the government at the International Geological Congress.

The field party directed by **R. K. Lynt** has completed topographic and geologic surveys of a portion of the Cold Bay oil fields, southwestern Alaska, and sailed from Kodiak for Seattle on Sept. 13.

**L. S. Cates**, general manager of the Utah Copper Co., was a late visitor to Ray, where he formerly was in charge of the interests of the Ray Consolidated Copper Co. He stopped in Jerome for a meeting of the Hull Copper Co.

**R. W. Stone**, Assistant State Geologist of Pennsylvania, has recently returned to Harrisburg from a 2,400-mile automobile trip through Pennsylvania. Mr. Stone spent five weeks visiting quarries of non-metallic structural materials.

**R. J. Spry** has severed his connection with the Mine & Smelter Supply Co., at Salt Lake City, to take over the superintendency of the new 100-ton mill being constructed by the A. H. Jones Co., of Salt Lake, for the Betty O'Neal Mines, near Battle Mountain, Nev.

**A. G. MacKenzie**, secretary of the Utah Chapter of the American Mining Congress, is a delegate to the conference of the National Tax Association, which meets in Minneapolis. Mr. MacKenzie has made a special study of taxation as it affects the mining industry of the West.

**Freeman F. Burr** has been appointed head of the department of geology at St. Lawrence University, at Canton, N. Y. During the summer months Mr. Burr will be open to engagement as a consulting and field geologist. His address at that time will be Sunrise Farm, Wayne, Me.

**Senator Key Pittman**, author of the Pittman Act, will meet in Salt Lake City, Sept. 12, with **Senator W. H. King**, of Utah, and a number of silver producers of the West to discuss the problem of a method of stabilizing the price of silver when the Pittman Act shall cease to be operative.

**F. A. Woodward**, general manager of the Iron Cap Copper Co., at Globe, Ariz., again is a candidate for the Arizona State Senate from Gila County. **Lewis Douglas**, head of the welfare department of the United Verde Extension Mining Co., and son of the corporation's president, has been nominated from Jerome to represent Yavapai County in the State House of Representatives.

A survey of all the clays of Florida has been conducted during the last two months by **Prof. Olin G. Bell**, of Cornell University, New York, **M. K. Cooke**, Assistant State Geologist of Florida, **Dr. F. H. H. Calhoun**, geologist of Clemson College, S. C., and **Strauss L. Lloyd**, mining engineer, of Inverness, Fla. In the execution of this survey, samples of all clays are being taken and shipped to a central point at Gainesville, Fla., where they are assembled and shipped by freight to the laboratory of Cornell University, and there tested for any and all purposes for which a clay can be used. Inasmuch as there are millions of tons of clay in the State of Florida, it is expected that this survey will result in opening up several ceramic industries in this part of the country.

**Harry H. Hill** has been designated to succeed F. B. Tough as supervisor of oil and gas leases of the Bureau of Mines. Mr. Hill has been serving the Bureau as superintendent of the Bartlesville experiment station since Jan. 1, 1921. He will be succeeded in that place by **Theodore E. Swigart**. Mr. Hill entered the service of the Bureau of Mines in July, 1913, as a junior chemist. He rose through the grades of assistant chemist, assistant chemical engineer, and chemical engineer, until his appointment as superintendent of the petroleum experiment station. He is a graduate of both the University of Wyoming and the University of Washington. Prior to joining the staff of the Bureau of Mines, he was a chemist in the service of the Canadian Mineral Rubber Co. Mr. Swigart comes from Oakland, Calif. He has been with the Bureau since March, 1919. His first position was that of assistant technologist in oil and gas production. Later he was promoted to the grade of petroleum technologist, and on July 1 of this year he was advanced to the grade of petroleum engineer. He is a graduate of the United States Naval Academy and of Leland Stanford University. In addition, he holds a degree in mechanical engineering from the reserve officers' school at Annapolis.

**Mining and metallurgical engineers** visiting New York City last week included: **Thomas S. Roberts**, of Morrisonville, N. Y.; **W. W. Weigel**, of Tuscaloosa, Ala., **A. H. Collbran**, of Seoul, Korea; **Dorsey A. Lyon**, of Washington, D. C.; **Frank W. Davis**, of Minneapolis, Minn.; **R. S. Oberly**, of Washington, D. C.; **H. H. Lauer**, of Allentown, Pa.; **John Davenport**, of Boston, Mass.; **H. Ries**, of Ithaca, N. Y.; **F. L. Wolf**, of Mansfield, Ohio; and **R. S. Everit**, of Pachuca, Hidalgo, Mexico.

## OBITUARY

**Ralph Williams**, a mining contractor of the Oatman section, was killed recently by the overturning of an auto on the Gold Roads highway, while on his way toward Kingman, Ariz.

**W. H. McVay**, a Slocan, B. C., operator, and at one time owner of the Ruth mine, at Sandon, died at Los Angeles on Aug. 19.

# THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

## Leading Events

RESCUE CREWS at Argonaut mine recover bodies of forty-seven men trapped by fire on Aug. 27.

Copper-mining companies in Michigan raised wages on Sept. 15. Although the Calumet & Hecla group has not yet announced an increase, its employees are earning 35 per cent more than the regular scale by virtue of a contract system.

A new silver field said to be "a second Cobalt" has been discovered at Red Lake, in northwestern Ontario. Limited work indicates promising possibilities.

Reports from California indicate growing activity in gold-mining districts.

Winona Copper Co. decides to open No. 2 King Phillip shaft in the Lake Copper Country.

A second shaft is planned by the Euterpe Mining Co. in the Joplin-Miami zinc-lead field.

The Davis-Daly and Anaconda companies confer, but fail to reach any agreement regarding the disputed orebodies in the Hesperus vein.

Increased gold output is the feature of the current operations in the Canadian mining industry, according to official report.

Americans have located many claims in Mexico recently.

## Finding of Forty-Seven Bodies Ends Twenty-Two Day Rescue Effort at Argonaut Mine

### Probable That Miners Perished Within Five Hours of Start of the Fire — Temporary Bulkheads Could Not Exclude Gas—Story of the Disaster

**LATE Monday night, Sept. 18, Byron O. Pickard, of the U. S. Bureau of Mines, and Ben Sanguinetti, underground boss for the Argonaut mine, at Jackson, Calif., broke down a rude bulkhead on the 4,350 level of the mine and found the bodies of the forty-seven miners who had been entombed since Aug. 27 as the result of a fire in the shaft. Notes left by the dead men are interpreted to show that the gas from the fire overcame the miners within five hours of the time the fire started. Rescue crews in twenty-one days of desperate work cleared 475 ft. of caved drift and solid rock on the 3,600 level of the adjoining Kennedy mine and 530 on the 3,900 level. Connection was made by the crew from Argonaut mine working on the 3,600 level.**

*By wire from our San Francisco correspondent*

**Jackson, Calif., Sept. 18.**—This morning at 4:55 connection was made on the 3,600 level with the 4,200 of the Argonaut after slightly over twenty-one days of desperate work and the clearing of 475 ft. of caved drift and solid rock on the 3,600 level and 530 ft. on the 3,900 level. Connection has not been made on the 3,900, where eighty-six feet of rock remain. Air from the Kennedy workings rushed into the Argonaut, and the first rescue squads of six men each entered the 4,200 level of the Argonaut, penetrating to the top of the raise from the 4,350 level. Conditions indicated possibility of the men being alive.

**Sept. 19.**—Following entry into the level a bulkhead was constructed in the shaft above the 4,200 level and rescue squads led by Rodney Hicox and B. F. McDonald, of the U. S. Bureau of Mines, descended to the 4,350 level and found a bulkhead that had been constructed by the entombed miners, in the drift on the Kennedy side of the Argonaut shaft. The compressed air line was extended from the Kennedy and the bulkhead was removed. A rescue squad led by Byron O. Pickard entered and found all of the miners dead. A note burned by acetylene flame on the mine timbers indicated that the men had perished from the effects of gas four or five hours after midnight on Aug. 27. The Argonaut miners had climbed from the lower three levels to the 4,350 and had constructed a bulkhead, using their clothes to make it tight. A second bulkhead had been hastily constructed within the first and a third had been started when the gas evidently overcame the men.

Few mining accidents have been so thoroughly brought to public attention as the tragedy at Argonaut. Profound feeling and sorrow are expressed throughout the nation. A thorough investigation will be made. Feeling is general that the committee directing operations, composed of E. C. Hutchinson, president of the Kennedy Co.; V. S. Gabarini, superintendent of the Argonaut, and F. W. Lowell, of the Industrial Accident Commission of California, used every facility at their command and did everything possible to expedite contact with the entombed miners.

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BY T. A. RICKARD

THE Argonaut mine is situated a mile north of Jackson, in Amador County, California; it is about ninety miles northeast of San Francisco. This mine is on the Mother Lode, a gold-bearing formation, or belt, that runs along the western slope of the foothills of the Sierra Nevada with a strike N. 20° W.

The Argonaut adjoins the Kennedy mine; their workings extend to a depth of nearly a mile; to be exact, the Argonaut is 4,275 ft. deep and the Kennedy 4,150 ft., part of this difference being due to the fact that the collar of the Argonaut shaft is 112 ft. higher than that of the Kennedy, owing to the contour of the ground. The Argonaut main shaft is 4,885 ft. long, because it is sunk on the dip of vein at an average angle of 63°. The Kennedy main shaft, which is vertical, starts at a considerable distance from the vein, on the hanging-wall side, and passes through it at a depth of 3,650 ft. The two shafts are 1,100 ft. apart.

The altitude above sea-level is 1,500 ft. The two mines are near the top of a ridge that commands a fine view southward over golden-brown foothills adorned with a parklike growth of evergreen oak. At I sat on the veranda of the Kennedy office yesterday, the manager pointed down the hill and said: "Do you see that patch

of burnt grass; that is where they are." He meant that 4,000 ft. vertically under that spot were the forty-seven men whose fate was our sole subject of interest.

On the night of Sunday, Aug. 27, the shaft of the Argonaut was found to be afire. Shortly after the midnight lunch-hour, a shift-boss and two skip-tenders at the 4,200-ft. station noticed the smell of smoke. They took the skip and went to the surface at once, and on their way up they noted that the fire extended for two sets just below the 3,000-ft. level. Communication with those below by means of the telephone and electric bell-line is said to have been broken by the fire. No signal of warning was given to the miners, who were working at the bottom of the mine, chiefly between the 4,800-ft. and 4,650-ft. levels. Nothing could be done to extricate them, because the fire prevented the use of the cage in the main shaft. There is another shaft, the Muldoon, which is 450 ft. south of the main shaft and is supposed to serve as a secondary exit, but it was not available because the draft was taking the smoke and gas into it from the main shaft. This was the established system of ventilation. The first thought appears to have been to ascertain the place and extent of the fire, and to check it. On Monday and Tuesday efforts were made to extinguish the fire by the use of water from above, but this proved futile. On Thursday it was decided to prevent the fire from spreading upward, by building a bulkhead across the shaft at the 2,400-ft. level, for by that time the fire had reached to within a short distance of the 2,500-ft. level. None of the men underground, of course, had been able to escape through the Muldoon shaft, and nothing was known concerning their fate.

It is necessary to explain that the Argonaut mine was on fire three years ago, in March, 1919; the fire spread into the Kennedy mine because the ventilation was from that mine into the Argonaut—and fire seeks oxygen. When the fire of 1919 had extended for a distance of 500 ft. northward into the Kennedy workings, the decision was made to cease pumping and to allow both mines to drown. To expedite this purpose, a large volume of water was admitted from the surface. That was in March, 1920. They remained under water until April, 1921, when they were unwatered and reopened. Only one life was lost in this fire.

Some of the upper workings of the two mines connect, or used to do so. The deep levels do not connect. This proved an unfortunate fact when it was decided, on the night of Monday, Aug. 28, to attempt a rescue by means of establishing communication with the men in the Argonaut through the Kennedy mine. Early on Tuesday morning the work was started. The fire of 1919 had burned the timbers in the Kennedy workings nearest to the Argonaut, and the admission of water in 1920 had caused the ground to cave so as to fill the levels with the mud and broken rock that had descended from the stopes as soon as the timbers were destroyed. It was decided to try to reach the imprisoned men along two lines of approach, one on the 3,600-ft. level and the other on the 3,900 of the Kennedy. The lower of these levels was clear for the longer distance, but to connect it with the Argonaut workings it would have to be advanced 140 ft. south through virgin rock. Altogether 475 ft. of rock and waste would have to be penetrated. By the 3,600 the total distance would be 530 ft., but the conditions appeared likely to be more favorable than on the 3,900, because less stoping had been done immediately above that level, which therefore, it was hoped, would be less choked with debris. The 3,600-ft. drift would have to be extended in two places through virgin ground for an aggregate distance of 130 ft.; it would enter the Argonaut at a point 60 ft. below the 4,200-ft. level of that mine. Thus the task of rescue consisted partly of digging new drifts through debris and partly of blasting a way through rock.

The whereabouts of the imprisoned men could only be guessed; the superintendent of the Argonaut thought that some of them would have gone to the north end of the 4,200 because that drift is behind the shaft and nearest to the Kennedy workings, from which, it was believed, there was a leakage of air. This place would be outside the line of the draft that was carrying the smoke and gases from the shaft into the workings below and southward. Others believed that the men would have made an attempt to escape through the Muldoon shaft and that they would be at the south end of the mine.

Ordinarily the miners work in shifts of eight hours; in order to hasten the rescue it was arranged for the men to work in shifts of six hours and in gangs of twenty men at each heading, two men working at the face for twenty minutes before being relieved by another pair. With good luck, an advance of 40 ft. could be made along a choked drift and 16 ft. could be driven in live rock in twenty-four hours. Everything was done to expedite the work of rescue and the staffs of the two mining companies cooperated loyally, despite the fact that litigation was pending between them.

## New Silver District Reported in Northwestern Ontario

A possible new silver field has been discovered at Red Lake, in northwestern Ontario close to the Manitoba boundary, by H. W. Cann, G. E. Hoyt, and R. J. Johnston, three Winnipeg prospectors. They have been prospecting in that region for four years, convinced that silver would be found there, but were unsuccessful until this season. Samples of the ore are stated to run from 500 to 1,500 oz. of silver to the ton. W. G. Trethewey, a mining engineer, is impressed with the importance of the discovery. The formation, he states, consists of Huronian slate, schist, and diorite, with at least two granite intrusions. The strike of the schistose or mineralized zone is approximately northeast and southwest and has been traced for a width of half a mile for a length of five miles.

## Lake Superior Copper Companies Raise Wages 15 Per Cent

The Quincy & Copper Range Consolidated companies, the latter operating the Champion, Baltic, and Trimountain mines, put into effect a wage increase of 15 per cent on Sept. 15. The action of these companies has in no sense been induced by increasing earnings or a better market for their product. The Lake has seen an increasing emigration of mining workers to other fields. The automotive centers have taken thousands. There are today only from 6,000 to 7,000 employees at the copper camps of Lake Superior, against normal operating forces of from 12,000 to 14,000.

That Calumet & Hecla has not yet announced an increase may be due to the fact that the bonus plan appears to be working out well, and that an extension of the system is planned. It is equivalent to a wage increase for every man accepting it. The payment of bonuses is largely limited at present to miners and trammers, but a bonus plan to apply to the wages of other employees is understood to be in course of preparation. The men are earning from $4.50 to $6 per day, according to the work done. The system has resulted in increased efficiency, more tonnage, and lower costs.

## More Efficient Work Expected as Result of Increased Wages

### P. G. Beckett, Phelps Dodge Manager, Asks Co-operation of Employees

Commenting on the late 10-per cent raise in the wages of copper miners in the chief Arizona camps, P. G. Beckett, general manager of the Phelps Dodge Corporation, states that the raise in a way is not justified by the condition of the copper market or the returns received by the producing corporations, adding, "As I have told our men, the wisdom and justification for this action depend on a thorough understanding on their part of why we are doing it at this time and the desire on their part to show us in the results of our operations each month that it was a good move and is justified under the present particularly difficult copper conditions."

The mine managers believe the wage increase will bring the copper miners at least on a level with other skilled trades, wherein recovery from post-war conditions has been more rapid than in mining, and that it will conduce toward a larger degree of contentment among their employees. Under the new scale, effective Oct. 1, Bisbee miners will receive $4.95 a shift and muckers $4.50. The raise will cover the camps of Globe, Miami, Bisbee, Douglas, Ajo, Jerome, Clarkdale, Clemenceau, Ray and Hayden.

# News from Washington

By PAUL WOOTON
Special Correspondent

## Tariff Bill Reported by Conference

### New Rates Are Comparatively Satisfactory to the Mining Industry—Cyanide on Free List

WIDE DIFFERENCES of opinion exist among leaders in Congress of the two major political parties as to the effect of the new tariff act as reported by the conference committee. Senator McCumber, chairman of the Finance Committee, for instance, estimates that the act will yield the government $400,000,000 in revenue in the first year of its life, and declares it will protect American industries and thus give employment to workmen at American standards of living, while Senator Simmons, ranking Democratic member of the Finance Committee and joint author of the 1913 tariff act, asserts the new act will shut out imports, make it impossible for Europe to purchase as heavily of American exports, and cost the consumers of the United States many millions of dollars in higher prices.

This is the first protective tariff bill written since the Payne-Aldrich act of 1909, excepting the emergency tariff of 1921, which included only agricultural products.

The new act has its ad valorem rates based upon foreign valuation, as has been the case in all previous tariff acts, excepting in the case of coal-tar products where the American selling price of a comparable article is the basis. The House passed the entire bill on the basis of American valuations.

This introduction of American valuation, which may be extended to other articles or products by the President if he considers the additional protection necessary, is a new feature of tariff legislation.

Aside from the changed rates, the outstanding features of the new tariff act are the steps taken by it to remove the question of tariff-making from politics and place it on a "scientific" basis, and the "flexible tariff" clause empowering the President to change rates, up or down, upon proper showing of necessity by the Tariff Commission.

The duties of the Tariff Commission are broadened to include more wide investigation of differences of cost of production here and abroad, the first step toward a tariff based upon straight lines of the differences in the actual cost of production.

Through the flexible tariff section of the new law, complaint against a rate may be lodged with the Tariff Commission, or that body may initiate investigations on its own responsibility, and reports of such investigations are to be submitted to the President, who may increase or decrease a rate as much as 50 per cent upon this showing; or, where he is convinced that an increase of 50 per cent would not equalize the cost of production, he may transfer an ad valorem rate to the basis of American valuation, but in such case cannot change the figure.

The following duties are of special interest to the mining industries. In some instances, duties now effective are indicated in parentheses:

Chalk, whiting or Paris white: Dry, ground, bolted or precipitated, 25 per cent.

Barytes ore, crude, $4 ton, (15 per cent); ground or otherwise manufactured, $7.50 ton, (20 per cent); barium sulphate precipitated, blanc-fixe, 1c., (20 per cent).

Ochers, siennas, and umbers, crude or unground, ½c., (5 per cent).

Zinc oxide and leaded zinc oxides containing not more than 25 per cent lead; ground dry, 1¾c.

Limestone (other than monument or building stone) crushed but not pulverized, 5c. per hundred pounds.

Magnesite: Crude ⅜c. lb.; caustic calcined, ⅝c. lb.; dead burned and grain, not suitable for manufacture into oxychloride cements, 23/40c. lb.

Plaster rock or gypsum, ground or calcined, $1.40 ton.

Pumice stone, unmanufactured value $15 or less per ton, ⅒c.

China clay or kaolin, $2.50 per ton, ($1.25).

Bauxite, crude, $1 per ton.

Fullers earth, unmanufactured, $1.50 per ton (75c.), manufactured, $3.25 ($1.50).

Fluorspar, $5.60 per ton, ($1.50)

Mica: Unmanufactured, value not over 15c. per lb., 4c.; over 15c., 25 per cent.

Plates, and built up, including manufactures of which mica is the material of chief value, 40 per cent; cut, trimmed, or splittings, 30 per cent. Ground mica, 20 per cent, (15 per cent); (valued not above 15c., 4c.; above 15c., 25 per cent).

Talc, steatite, soapstone, French chalk, crude and unground, ¼c.; ground, washed, powdered, etc., (except toilet preparations) 25 per cent; cut, sawed, in blanks, crayons, cubes, etc., 1c.

Graphite or plumbago, crude or refined: Amorphous, 10 per cent; crystalline lump, chip, or dust, 20 per cent; crystalline flake, 1¼c.

Manganese ore or concentrates, 1c. on metallic manganese content.

Molybdenum ore or concentrates, 35c. on molybdenum content (15 per cent).

Tungsten ore or concentrates, 45c. on tungsten content (15 per cent).

Aluminum, aluminum scrap, and alloys of which aluminum is the component material of chief value, in crude form 5c. per lb. (2c.).

Antimony, as regulas or metal, 2c. per lb. (10 per cent).

Bismuth, 7½ per cent.

Cadmium, 15c.

Metallic arsenic, 6c.

Copper in rolls, rods, or sheets, 2½c. per lb.

Magnesium, metallic and scrap, 40c. lb.

Quicksilver, 25c. per lb, (10 per cent).

Dynamite and other high explosives, in sticks, cartridges, etc., suitable for blasting, 1¼c.

Nickel and alloys of which nickel is component of chief value, in pigs or ingots, shot, cubes, grams, cathodes, or similar forms, 3c. per lb. (20 per cent).

Lead-bearing ores and mattes of all kinds, 1½c. per lb. on lead content (¾c.). The duty would not apply to lead contained in copper mattes unless actually recovered.

Lead bullion or base bullion, lead in pigs and bars, lead dross, reclaimed lead, scrap lead, antimonial lead and scrap lead, 2¾c. per lb. on lead content (25 per cent).

Zinc-bearing ores of all kinds, containing less than 10 per cent zinc, free of duty, containing 10 to 20 per cent zinc, ½c. per lb. on zinc content; containing 20 to 25 per cent zinc, 1c. per lb. on zinc content; containing 25 per cent or more zinc, 1½c. per lb. on zinc content.

Zinc in blocks or pigs and zinc dust, 1¾c.; in sheets, 2c.; in sheets coated or plated with nickel or other metals except gold or silver, or solutions, 2¼c.

Asbestos and woven fabrics, wholly or in chief value of asbestos, 30 per cent; all other manufactures of asbestos, 25 per cent.

Emery and corundum grains and emery and corundum ground, refined or manufactured, including artificial abrasives, 1c. per lb.

Blasting caps, containing not over one gram of explosives, $2.25 per M.; containing over one gram of explosives, 75c. per M. additional for each half gram.

Mining, blasting, or safety fuses, $1 per thousand feet.

Diamonds and other precious stones, rough or uncut, not set, and diamond dust, 10 per cent; pearls, and parts, drilled or not, unset or unstrung, 20 per cent.

Among the items on the free list are the following:

Arsenious acid or white arsenic.

Asbestos, unmanufactured, asbestos crudes, fibers, stucco, sand and refuse containing not over 15 per cent foreign matter.

Borax, crude or unmanufactured.

Chalk, crude, not ground, bolted, precipitated, or otherwise manufactured.

Chromite or chrome ore.

Cobalt and cobalt ore.

Copper ore; regulus of, and black or coarse copper and cement copper.

Cryolite.

Cyanide: potassium cyanide, sodium cyanide, all cyanide salts, mixtures, combinations, and compounds not separately provided for.

Emery ore, corundum ore, and crude artificial abrasives.

Sulphur in any form, and sulphur ore, etc.

Tin ore or cassiterite, and black oxide of tin; except that there would be imposed upon cassiterite, or black oxide of tin, a duty of 4c. per lb., and upon bar, block, and pig tin a duty of 6c. per lb. whenever it is made to appear to the President that the mines of the United States are producing 1,500 tons of cassiterite and bar, block, and pig tin per year.

# Arizona Copper Companies Depend on Colorado River Power Development

## Federal Power Commission Debates Advisability of Granting Diamond Creek License—Excessive Cost of Oil Fuel Slackens Operations

COMPETITIVE conditions among the copper producers are such as to make certain that the copper mining companies of Arizona will do all in their power to secure early action by the Federal Power Commission which will allow them to construct a large hydro-electric plant on the Colorado River. The extension of the preliminary permit granted James B. Girand will expire on Oct. 19. The indications at this writing are that the commission will not be in a position at that time to issue the license. It is understood that arrangements have been made whereby Mr. Girand will assign the license, when granted, to the copper companies.

The copper producers in Arizona must compete with those of Montana and Utah. The Montana producers are supplied power by the Montana Power Co., which produces about the cheapest power to be had in the United States. That company is in a position to add any amount that may be required to its power output by developing additional sites along the Missouri River and on the Flathead River. The Utah copper producers also are supplied with comparatively cheap power, and for them plenty of additional power is obtainable from the Green River.

On the other hand, the Arizona producers are depending on fuel oil. They already are suffering on account of its increased cost, and there is no certainty that future increases will not reach a point where the operations of the Arizona companies will be curtailed seriously. Their situation is such that they will exert every effort to expedite the development of Colorado River power.

The Diamond Creek development, which is that covered by the Girand permit, was recommended by the engineers who studied the situation for the copper companies. These engineers, which included representatives of the Montana Power Co., found that the Arizona copper producers would be justified in the heavy expense that would be entailed by the projected works and by the installation necessary to convey the power all the way from the Colorado River to Clifton and Globe. As this probably will require a 220,000-v. installation, the cost is estimated at $34,000 per mile.

The Federal Power Commission was ready to issue the Girand license, but in view of very insistent objection on the part of those directly concerned with the proposed development at Boulder Canyon, it was necessary to extend the preliminary permit with the purpose of encouraging negotiations through which an understanding could be reached. The commissioner does not want to see this large market for power taken away from the 600,000 hp. development proposed at that point. The Secretary of the Interior, one of the members of the Federal Power Commission, is opposed to the Diamond Creek development, as is Arthur P. Davis, the Director of the U. S. Reclamation Service.

Some are of the opinion that a solution of the difficulty might be had in the construction of a 300-ft. dam at Black Canyon. Since the Southern California Edison Co. is in a position to operate such a development in a more economical manner than could the copper companies, it is suggested that a project in the hands of that company at Black Canyon would meet the requirements of the copper companies and at the same time the excess could be absorbed by the Southern California Edison. It also would be easier for that company to build up a market for the power during the periods that the copper properties would not be operated. Provision has to be made for intermittency in the copper industry, it is pointed out. Black Canyon is just as available from the railroad. Construction costs would be about the same, and is would be possible to obtain about 5,000,000 acre-feet of storage, while at Diamond Creek little storage capacity is available. This latter consideration is of particular importance because it reduces the flood hazard below.

## Rehearing of Coronado Case Asked by Company

A petition for a rehearing of the so-called Coronado coal case, in which the United States Supreme Court on June 5 handed down a noteworthy decision holding that labor unions, although not incorporated, are suable and liable for damages resulting from acts of their members on an authorized strike in matters affecting interstate commerce, has just been filed with the court by John W. Davis in behalf of the Coronado Coal Co., and others, plaintiffs in the original suit against the United Mine Workers of America.

The Supreme Court, while rendering a broad opinion in the case and establishing a new principle of legal procedure against labor unions, held that it could not sustain the award of damages to the original plaintiffs because it had not been established to the satisfaction of the court that the acts complained of were in restraint of interstate commerce during an authorized strike, and expressed regret that this was so.

An award of judgment against the union is again urged because "the mere lapse of time since the injury was incurred will inevitably embarrass the further prosecution of the cause."

## War Minerals Commission Makes Interesting Decisions

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commission has recommended awards as follows: T. E. Martin, Los Angeles, $1,702.04; W. H. Bemenderfer, Caliente, Cal., $1,600.98; Roy Glasscock, Mount Vernon, Ore., $3,761.12; Edward D. May, Smith River, Cal., $402.85; A. W. Lewis, Crescent City, Cal., $333.93; Ohlheiser, Hawkins & Van Buren, Crescent City, Cal., $2,331.75; C. E. Loofbourrow, Oakland, Cal., $1,340.74. Disallowances were as follows: Aguilera & Co., Santiago, Cuba, not within the act; I. M. Cross, Ocean Beach, Cal., stimulation not established; C. L. Moody, not within the act; Thurston & Hardy, Miami, Ariz., not within the act.

The Bemenderfer claim is one of those which was mailed before the limit set in the original act, but which did not reach Washington before the expiration of the time limit. Under the amended act, such claims may be considered. Under the amended act, Glasscock was able to establish stimulation as of Sept. 7, 1917. Thurston & Hardy were asking to be reimbursed for a part of the amount they were called upon to pay for liability in the death of a workman. There was a small profit made on their operation, but with the payment of liability to the widow they are able to show a deficit of $3,636.56, which they ask the government to pay. A disallowance was recommended because the War Minerals Relief Commission holds that they should have taken out liability insurance. In neglecting to do so, they, in effect, elected to carry their own insurance—a personal risk and one for which the commissioner believes the government should not be held responsible.

## Government Statistics Show Mining Activity in Mexico

Figures issued by the Mining Department of the Federal Office of Industry and Commerce at Mexico City show the output of the principal metals as follows:

METAL PRODUCTION OF MEXICO

| | June, 1922 | | First Six Months, 1922 | |
|---|---|---|---|---|
| | Kg. | Value, Pesos | Kg. | Value, Pesos |
| Gold | 1,882 | 2,509,327.06 | 11,145 | 14,759,962.85 |
| Silver | 210,857 | 9,950,341.83 | 1,195,355 | 53,133,202.14 |
| Copper | 1,791,822 | 1,039,256.76 | 6,479,008 | 3,834,830.23 |
| Lead | 8,995,145 | 2,068,883.35 | 47,065,160 | 10,161,957.28 |
| Zinc | 545,246 | 130,858.04 | 1,064,929 | 249,117.32 |
| Mercury | 5,798 | 18,495.62 | 17,045 | 52,152.98 |
| Arsenic | | | 63,252 | 20,240.64 |
| Antimony | 29,547 | 7,977.69 | 275,186 | 64,474.66 |
| Graphite | 270,700 | 24,363.00 | 1,306,098 | 96,820.86 |
| Total value | | 15,749,503.35 | | 82,372,758.96 |

# News by Mining Districts

## London Letter

### Rumor Says Guggenheims Seek British Canadian Silver Shares—Good Ore in South Kalgurli

BY W. A. DOMAN

**London, Sept. 8**—Since Sept. 1 there has been a change of policy at the Modderfontein East mine (Transvaal). There are three shafts serving the property. No. 1 has opened up a rich section, and from Nos. 2 and 3 ore of medium grade has been disclosed. Hitherto both development and stoping operations were carried on in all three areas. Now, however, work at Nos. 2 and 3 shafts is suspended, efforts being concentrated at No. 1 in the hope of extending the rich zone, the object being to increase the company's profits to pay off the debenture debt, which amounts to £400,000. In the event of hopes being fulfilled, further capital will be raised to erect the company's own plant of 50,000 tons' monthly capacity, for which the large tonnage standing developed in the Nos. 2 and 3 shaft sections would be then available for treatment. Last month the company milled 27,000 tons, for a yield of 11,747 oz. of gold, which had an estimated value of £52,507, and of which £15,159 remained as working profit. (At present treatment is carried on at the Apex plant of the New Kleinfontein.)

A jump of 20s. a share in one day in Mexico Mines of El Oro caused considerable excitement and comment, seeing that no explanation was forthcoming. Rumors circulated of the discovery of a new deposit, but inquiries failed to elicit any confirmation. The best reason seems to be that shares sold by a firm of jobbers were not on their books, and the endeavor to secure them led to the sudden advance.

It is reported that the Selukwe Gold Mining & Finance Co. has received an offer of $5,000,000 for its shares in the British Canadian Silver Corporation. This would be equal to 25s. a share. The offer is said to have been made by the Guggenheims, owners of the adjoining claims, who are of the opinion that the rich deposit in their area extends into the British Canadian Silver Corporation ground. There seem to be two opinions among the directors, one party being for acceptance, and the other for continuing drilling and taking for the Selukwe itself the risks which are regarded as good. The $5,000,000 is to be payable over four years.

At the 1,600 level, the South Kalgurli has encountered a good run of ore, something much in excess of the average value of the reserves. For a length of 90 ft. the reef has a width of 5 ft., and during the past three months, with the exception of the last 13 ft., the gold content has never been less than 12 dwt., the general value being between 14 dwt. and 17 dwt. For a mine that had at one time reached the doubtful stage, this is regarded as encouraging.

A good deal of attention is being paid to the shares of the Mexican Corporation on account of the improved results obtained at the Fresnillo mill. In the three months ended June 30, costs were reduced to an average of $2.21 per ton, this comparing with $2.32 in the March quarter. The mill ran to 92 per cent of capacity, the decrease resulting from irregular power service. For the three months 231,624 tons was treated, for a recovery of $749,647 and a mine profit of $232,097, of which $139,258 accrued to the Mexican Corporation.

## Johannesburg Letter

### Diamonds Found Near Vryburg—Two Rebel Leaders Receive Death Sentence

BY JOHN WATSON

**Johannesburg, Aug. 18.**—The output of gold for the Transvaal for the month of July was declared by the Chamber of Mines, on Aug. 10, to be 730,635 oz., which is an increase over June of 54,938 oz. The Witwatersrand mines show an increase of 55,036 oz., but the outside districts have a decrease of 98 oz. The most notable increases are from Crown mines, 9,627 oz.; Brakpan, 6,987 (including strike clean-up); Randfontein, 5,937; Consolidated Main Reef, 4,553; and Robinson Deep, 3,533 oz. of fine gold. The value of the July gold output was £3,360,921, the price realized having been 92 s. per oz—i.e., 6 d. per oz. less than for June. The native labor returns for July show an increase of 2,422 "boys" on the gold mines.

In the Klerksdorp district, a twenty-stamp battery has been erected at the Africander mine, and it is hoped to start crushing during the next fortnight or so. The prospects are said to be encouraging. The old Buffelsdoorn mine is also to be re-started by a new company, recently formed. The plant, including a ten-stamp mill, is now arriving.

Prospecting for diamonds has been carried out on the town commonage at Vryburg (Northern Cape Province), for some weeks, several small stones having been found. Last week, a beautiful diamond of 12¼ carats was found.

On Aug. 17, "Wood's Farm" (Kareefontein) is to be proclaimed as public alluvial diggings. This is near the Vaal River, about six miles from Bloemhof, Western Transvaal.

Following up W. P. Taylor's advocacy of working gold in the Patchefstroom district, S. L. Kling has been recounting his experiences of gold mining in that district since 1889. Some of the bore holes drilled were with antiquated appliances which could not penetrate the diabase under the Black Reef series. Black Reef outcrops, in the Patchefstroom district, may possibly be worked, at a profit, by modern methods. Boring for the Main Reef series should be carried out, Kling considers, twelve to twenty miles west of Patchefstroom. Large areas should be worked by a company with ample capital, by the most modern and up-to-date methods. It is not a field for the small man or small syndicate. The Mooi River valley could be used to give an ample water supply.

Trials of rebel leaders by the Special Court (presided over by Sir John Dove Wilson) are being conducted in Johannesburg. On Aug. 9, Carel Christian Stassen was sentenced to death for the murder of two natives at Sophiatown (Western Johannesburg) on March 8. Johannes Brussoneo was sentenced to death on Aug. 11 for the murder of a mine policeman near Florida on March 11. On Aug. 10, A. R. van Zyl was found guilty of culpable homicide and sentenced to three years' imprisonment with hard labor, and J. Morelee and P. B. van Rooyen received each a sentence of two and one-half years' imprisonment with hard labor. These three were leaders in the attack on mine natives at the New Primrose compound on March 8.

The General Mining & Finance Corporation—the parent of the Albu group of Transvaal mines—has at last an opportunity of seriously tackling its capital position, and it is interesting to note how deeply German investors were involved. About 800,000 ex-enemy shares, out of a total of 1,875,000, were bought from the custodians at 2s. each, and will be cancelled, and the difference of 18s. a share will be used in writing off depreciation of assets—£1,186,786. No hint is given in the report of the reopening of the Cinderella Consolidated mine on the East Rand; it is simply stated that lower working costs should have a beneficial influence on raising the additional capital needed.

## Melbourne Letter

### Bendigo Gold Output Dwindles—Embargo Proposed on Export of Ores

BY PETER G. TAIT

**Melbourne, Aug. 15.**—The Briseis tin mine, at Derby, Tasmania, has completed the diversion of the Ringarooma River, and sluicing operations will be resumed immediately, first on the Ringarooma face and later in the Kruska flat. The ground ahead which has been prospected is estimated to contain more than 3,000 tons of tin. The lead is considerably below the river level, and the close proximity of the diversion to the workings entails a careful watchfulness on the part of the staff, particularly in times of flood.

During July the Australian Gold Producers' Association sold approximately 141,379 oz. of standard gold, which brought an estimated net average price of £4 4s. 3d. per ounce, equal to £4 11s. 11d. per ounce. The average London price (gross) for the month was £4 12s. 9d. per ounce. The whole of the gold production for the half year ended

June 30, as shown by mint certificates lodged with the association, has been sold, but delay in obtaining detailed statements from India has retarded the half-yearly balance and completion of the audit of accounts. It is estimated that the distributable premium for the half year, less reserve for adjustment and contingencies, will amount to 6s. 8d. per ounce standard, and the board hopes to distribute this on or about Sept. 15 (less the amount of the interim distribution made on June 25), together with the unexpended balance of the sum set aside at Dec. 31, 1921, for adjustments and contingencies.

The Bendigo gold field has been attracting attention by reason of profitable yields from the New Red, White and Blue, but the latest returns show a falling off in the average yields. The Bendigo Amalgamated has not met with consistent success in prospecting. Arthur Moline, of the Amalgamated, reports that "The most attractive of the company's prospects had failed to respond to developments and the immediate supplies of payable stone were becoming exhausted." The company has taken an option over Williams Brothers' mine at Wandiligong, which is evidence that its management is not very hopeful in regard to Bendigo, and yet the weight of evidence is that Bendigo is not by any means an exhausted gold field.

Since the closing down of the Sulphide Corporation's smelting works at Cockle Creek, the Broken Hill Associated Smelters at Port Pirie is practically the sole buyer for local treatment of silver-lead concentrates in Australia. This company operates the works previously controlled by the Broken Hill Proprietary Co. Its principal source of concentrates is the Broken Hill field, but owing to the reduction of operations consequent on the thirty-five-hour week, and the limitation to one shift daily, even if all the Barrier mines were operating to full capacity the tonnage forthcoming would not be sufficient to keep the smelting works in full blast, and therefore the company has entered the field as a buyer of outside ores. It has found, naturally, that the high cost of local treatment, together with the exorbitant rates ruling for coastal freights and coal, is a serious handicap in competition with prices offered by buyers for export, and it has entered on a press campaign urging an embargo being placed on the export of ores. It is recognized, however, that this would give the Broken Hill a practical monopoly and that the producers would therefore suffer. The mining industry generally is so depressed that the present would be a very inopportune time to do anything that would further handicap the producers. The primary industry (mining) must be encouraged, because if it is not developed the secondary industry of smelting cannot hope to succeed, even with an embargo. It would of course avail Broken Hill nothing if the result of an embargo were to cause the mines to suspend production.

## BRITISH COLUMBIA

### Copper Mountain Mine Is Examined

**Alice Arm**—The Silver Bar Mining Co. is building a camp and getting in supplies on its property on the northeast fork of the Kitsault River, so as to continue development during the winter. A. McGuire is in charge. Louis Reynolds, one of the owners of the Beverley group, on the opposite side of the bay from here, reports that a 40-ft. belt of ore has been stripped for 100 ft. on the surface, and that several patches of rich silver ore have been exposed. A tunnel has been started on the lode.

**Hudson's Hope**—W. H. Wood, one of the directors of the Manitoba Gold Dredging Co., who has just returned from the company's property, on the upper Peace River, reports that a dredge is in operation.

**Princeton**—A party of engineers has made an examination of the Canada Copper Corporation's mine, at Copper Mountain, and its concentrator, at Allenby, for the Granby company, and G. N. Bjorge and E. E. Erich have made an examination of the property for San Francisco capitalists. Fred Foster, acting for Spokane capitalists, has bonded the Horne Silver mine, at Samilkameen, for $45,000, with the understanding that forty days is to be given for an inspection. Horne Silver has been a steady shipper of small quantities of high-grade silver-lead ore.

**Nelson**—California Mining Co., which operates the California, Exchequer, and Athabasca groups, on Toad Mountain, near here, has closed its Athabasca mill on account of heavy losses. It is probable that a ball mill and cyanide plant will be added to the present stamps, plates, and concentrators.

The Florence mine, at Ainsworth, made the first shipment of concentrate, recently, since the owners again took over the mine from lessees, who had been operating parts of it for some time.

**Barkerville**—There has been a marked revival of prospecting for quartz lodes in this district, and several promising discoveries have been made. E. Moore has uncovered a 60-ft. lode on upper Cunningham and Harvey creeks. The quartz is well mineralized and shows some free gold.

Owing to the unusually dry season and consequent shortage of water the placer output of the Cariboo district is likely to fall below the average. This is to be regretted, as more mining has been done than at any time since the war, and some promising ground has been mined, but there is little prospect of the miners being able to wash it this year. A Keystone drill has been put into operation on Cunningham Creek recently.

**Stewart**—A. B. Trites, of Fernie, B. C., has bonded the Unicorn group of four claims, which adjoin the Big Missouri, which Trites and associates also have under option. Gus Seiffert has bonded the Rufus group of seven claims on the north side of Bear River. Some promising silver and copper ore has been uncovered on the surface at an elevation of 5,000 ft. Supplies will be taken to the property during the coming winter, and an active campaign of development will be started in the spring. G. D. B. Turner has bonded the Mobile group, on Glacier Creek. Mr. Turner and associates have several other properties under option.

H. G. Magee reports the discovery of an 8-ft. vein on the Patricia group, on Marmot River. A sample taken from the vein gave an assay of 704 oz. silver per ton and 44 per cent lead. The ore is much oxidized. A tunnel has been started on the vein.

**Salmo**—The Long crosscut tunnel on the Bayonne mine near here has entered the oreshoot exposed in the upper workings, and drifting on the vein has progressed 40 ft., according to the report of B. N. Sharp, manager. The crosscut intersects the vein 700 ft. below the outcrop and 170 ft. below the No. 2 level. The vein on the crosscut level is 2½ ft. wide and carries $12.80 in gold.

**Sandon**—The Silversmith mine will spend $50,000 before winter in new mill and mine equipment. A 200 hp. Diesel engine as an auxiliary unit to the power plant will be installed. A new filter will be added to the mill and erection of zinc bins and a new boarding house will soon be started. The company is operating on a three-shift basis and shipping 750 tons of lead-silver and zinc concentrates monthly.

## PHILIPPINE ISLANDS

### Platinum Deposits of Little Importance Says Official in Manila

**Manila**—Platinum has been found in the Island of Mindanao, P. I., but not in the rich deposits indicated by newspaper reports, according to Warren D. Smith, chief of the Division of Mines, Bureau of Science, in the Philippines. He explains that a sample consisting of 42 g. of concentrates (not ore, as stated in the news story, there being a very great difference between the two) and containing platinum was submitted to the chemical laboratory of the bureau. These concentrates were the result of a clean-up of approximately 10,000 cu.yd. of dirt. Of these 42 g. of concentrates, 28.673 g. proved to be platinum, according to report of the division of inorganic chemistry and, in addition, there was 2.867 g. of gold. That is to say, of this amount of concentrates 68.27 per cent was platinum and 6.82 per cent gold. The reason for the small amount of gold is that the bulk of the gold had already been recovered on the tables of the dredge and that part of the concentrates submitted to the Bureau of Science represented the part that had not become amalgamated with mercury. The amount of platinum recovered is less than one ounce, which puts quite a different complexion upon the story, as approximately one ounce of platinum from 10,000 cu.yd. of dirt handled would by no means indicate a workable deposit.

## MEXICO

### Americans Have Located Many Claims During Past Month

**Durango**—The land and buildings belonging to the Cia. Minera y Explotadora de Ventanas, a once prosperous mining company operating near Ventanas, in this state, are advertised for sale at public auction to satisfy delinquent taxes amounting to over 4,000 pesos plus additional expenses.

**Saltillo**—Conditions are reported critical at the coal camps of Rosita, Agujita, Eperanza, and Menor, in the northern part of this state. Coal having been largely substituted by oil, there is no demand for it on the market, and the coal mines have reduced their working forces, throwing men out of employment, who are in destitute circumstances. At Mineral de Paula, in this coal region, a large deposit of good coal has been recently discovered in shaft No. 3 and a number of additional miners are being employed, but the company will not be able to give work to the hordes which are rushing there from the other camps.

**Torreon**—American prospectors and mining men are active in northern Mexico. During the last month the following properties were located and recorded by foreigners, principally Americans:

Nueva Libertad, composed of thirty-seven claims, situated at Temosachic, in the State of Chihuahua, recorded by William M. Ferris and Frank S. Black.

The Santa Margarita Grande, district of Ocampo, Chihuahua, located by Henry Weber and Ralph Benton.

El Sita, silver-lead property, in the Ramirez Mountains, near San Juan de Guadalupe, by Arthur Frey.

La Leona, fifteen claims, in the Bemejilla Mountains, near Mapimi, State of Durango, by Oscar F. Franke.

The Purisima, silver-lead, a group of sixty contiguous pertenencias, at La Noria, one of the principal camps of the Sombrerte district, State of Zacatecas, by George H. Davis.

Guadalupana, gold, silver, and lead, San Diego camp near Pueblo Nuevo, Durango, by Edward Hartman.

Hudson, four claims, Villa Gonzalez, south of Juarez, State of Chihuahua, by M. G. Hudson and E. D. Edison. Also a group of four claims carrying silver, lead, and zinc to be known as the Moore, in the same region and by the same persons.

**Nacozari**—The Moctezuma Copper Co. expects to have the third unit of its concentrator ready for operating by Jan. 1, 1923. The total number of men employed by the company at present is 1,519 and upon completion of the third unit, if the copper market will permit, it will be able to employ 300 to 400 more men.

**Durango**—The Guanaceví unit of the Cia. Minera de Peñoles has commenced developing the Santa Cruz mine, employing about twenty men in sinking a shaft.

The Cia. Minera y Beneficiadora de Guanaceví is increasing its work in La Mexicana mine, where it now employs about 100 men and is also deepening the shaft of Paleros mine.

**Esmeralda (Coahuila)**—The American Smelting & Refining Co. is producing regularly from its San Jose claim and is developing the Fronteriza mining property. The Trinidad mine is again producing a good grade of ore. Lessees at the Fortuna are producing 200 to 300 tons of lead ore per month. The monthly output of the Veta Rica continues to be about 600 tons.

## ARIZONA

### Merger of Jerome Properties Progresses —Old Dominion Profits from Sale of Water

BY JAMES H. MCCLINTOCK

**Phoenix**—James M. Layman, in his consolidation plans at Jerome, is considering a 10,000-ft. tunnel that would cut the Copper Chief and Equator ground at 2,000-ft. depth. Green Monster is still out of the combination. Its stockholders are considering the Layman offer of one share of stock in the new Verde Consolidated Mines & Tunnel Co. for three shares of Green Monster. Stock now is being pooled of the Copper Chief, Equator, Copper Chief Extension, Layman-Washburn, and Larson-Colbath organizations, which it is stated are already secured, whatever becomes of the Green Monster negotiations. There is to be a sale at 50c. of 1,000,000 shares of pre-organization stock, with supplemental offer of 500,000 shares at $1.

The Mexican Metals Recovery Co., of El Paso, has filed its articles with the Arizona Corporation Commission, with John F. Ross, of Tombstone, named as resident agent. The directors are Elgin B. Holt, C. W. Goedeke, D. A. Richardson, George F. Williams, J. E. McIntyre, J. J. O'Brien and W. V. Wright.

The Night Hawk Leasing Co., whose operations are at Bisbee, has announced a 10c. dividend.

**Ajo**—The last big shot has been fired in the surface carbonates of the New Cornelia Copper Co. The discharge of 18,000 lb. of powder broke down about 60,000 tons of ore, leaving little standing of the last of the three hills that formerly marked Ajo from the desert. The new well shaft has been completed to the depth of 650 ft., and now a drift is being run to connect with the old shaft at the depth. This drift in size is 12 by 14 ft. Construction of the new mill is expected to start within a month.

**Globe**—The Old Dominion is disposing in two ways of the water pumped from its property. It has a ten-year contract with the Miami Copper Co. for 1,000,000 gal. a day of ordinary mine water, delivered as it comes from the drain tunnel. This at the rate of 5c. per 1,000 gal. In addition, there is a special delivery of pure water to the city of Globe, that is taken from a long separate drift by separate pipes and pumps and then repumped from the surface to the city reservoir. For this a charge is made of 12½c. per 1,000 gal.

## CALIFORNIA

### General Activity Is Apparent in Gold Mining Camps

*By Our Special Correspondent*

**San Francisco**—Ten stamps were added to the Central Eureka mill, Sutter Creek, Amador County, recently. The 3,900 south drift in the mine has been repaired and development work has been started in the South Eureka.

New operators of the Bush Creek mine, near Alleghany, will extend an old tunnel about 1,500 ft. to intersect the present shaft close to the bottom, or 800 ft. form the surface.

A discovery of gold ore is reported from Coquett Creek, in Plumas County, five miles from the Butte County line and ten miles northeast of Merrimac.

The Irelan Mines Co. has been incorporated to operate the Irelan mine, near the Tightner-Sixteen to One group at Alleghany, Sierra County. The incorporators are H. N. Yates, Pacific Grove; W. L. Waldron, Grass Valley; D. C. Smith, Meridian; F. L. Fisher, Meridian; and A. C. Irwin, Marysville. The Irelan mine has been in operation for several years and is fully equipped.

The concrete foundation for the new hoist at the Brunswick property at Grass Valley has been completed. The shafts and workings of the mine are to be unwatered as a preliminary to the resumption of operations.

The American Bar Quartz Mining Co., operating on the American River, is reported to have discovered a rich ledge between Michigan Bluff and the American River. The ledge is stated to be 4 ft. wide and to have been opened up for a length of 175 ft.

The Black Oak mine, at Soulsbyville, which has been inactive for two years, has been financed by strong New York interests, who will resume operations at an early date.

The Golden Gate mine, one mile south of Sonora, is being reopened by its owner, Andrew McCormick. The property, which has been shut down for about fifteen years, was formerly a heavy producer.

The Chileno mine, on Jackass Hill, near Tuttletown, is being developed under bond by the Nevada Wonder Mining Co.

The Crystalline and Alabama claims, near the Harvard mine, are being developed by the Tonopah Mining Co.

The Shawmut mine, near Sonora, had a disastrous wreck in its main shaft due to caving of the hanging wall. Both skips with their cables and much of the track and pipe lines are in the bottom of the shaft. A skilled crew has been brought from Tonopah to repair the damage. Operation of the mill will be suspended until October.

The entire mine plant and mill of the Clio mine, near Jacksonville, was totally destroyed by fire on Aug. 19.

The Harriman mine, on the river above Jacksonville, which was being operated under bond by Spokane parties, has shut down.

The Parole mine, about six miles northwest of Tuolumne, is sinking a new shaft.

The Grizzly Mining Co., at Tuolumne, is sinking the old Dead Horse shaft an additional 300 ft. to the 2,200 level.

The Dreisam mine, four miles north of Tuolumne, is under option to W. B. Morris, who intends to unwater and develop at once.

## OREGON

### Two Plants Expected to Start Operation This Fall

**Baker**—Charles Zahner, who recently leased the Magnolia mill for treating ore from the Blue Ribbon mine, expects to have the plant in operation this fall. On account of a shortage of water, it has been found necessary to build an auxiliary pipe line around to Crane Creek.

The new mill being built at the La Bellevue mine, near Granite, should be in operation by the first of November. The plant will have a capacity of sixty tons daily. The completion and starting of this mill will bring a property back to producing which has been idle since 1896.

## WASHINGTON

### Gold Mines Near Republic Resume Operations

**Springdale**—The Santa Rita Mining Co., eighteen miles west of here, is shipping four to five carloads of lead-silver and zinc concentrates per month. The ore, which is milled in the fifty-ton concentrator, is being taken out during development operations. The company is considering the installation of a 100 hp. Diesel-type engine, and plans for extensive development during the winter.

**Republic**—Gradually the gold-mining industry of this district is assuming pre-war activity, the Last Chance mine being the latest to enter the list of active mines here. Work of unwatering the 700-ft. vertical shaft and workings has been started. The mine has been idle since 1917 owing to apex litigation started by the Northport Smelting & Refining Co., owning the adjoining Lone Pine-Surprise mine. The Last Chance company has been successful in the lower and higher courts in defending its rights to the vein, and will begin immediately to mine the ore developed between the 500 and 700 levels. Before the shutdown the company was shipping twelve to sixteen cars of gold ore averaging $12 per ton, according to C. P. Robbins, manager.

Shipments are going forward each week to Trail from the Quilp and Lone Pine-Surprise properties.

A winze is being sunk from the 200 level of the Knob Hill mine, which has recently been taken over by new owners said to be connected with the Balaklava mine of California. This property has produced $600,000 in gold ore, out of which several dividends have been distributed.

**Chewelah**—Additional damage claims, aggregating $44,000, were filed recently against the Northwest Magnesite Co. for alleged damage to farm lands in the vicinity of the magnesite plant.

## NEVADA

### Tonopah Production $650,000 for August—Pittsburgh-Silver Peak To Be Reopened

**Tonopah**—August bullion production of the Tonopah District was approximately $650,000. Shipments representing clean-up of operations for the last fifteen days of August were as follows; Tonopah Belmont, $117,000; West End, $101,800; Tonopah Extension, $70,000; Tonopah Mining, $60,000. These figures are about normal.

Favorable reports continue to be given out regarding conditions on the 1880 level of the Tonopah Extension and possibilities for a continuation of the larger shoots to the 2,000 and 2,100 levels.

On Sept. 10 the West End relinquished its lease on the MacNamara mill, after operating it for six months on West End ores. This temporarily reduces West End tonnage approximately seventy-five tons, to about 250 tons per day.

**Silver Peak**—It is reported that the Lucky Boy Divide Mining Co. has taken over the property of the old Pittsburgh-Silver Peak Mining Co., about nine miles from Silver Peak. This is an old property with a creditable production record in both high- and low-grade ores. Originally the mine was worked as a low tonnage, high-grade mine, but before it was finally closed down production reached 500 tons per day and the glory-hole method of mining was in use. Later lessees put up a small mill at Silver Peak, but were unable to operate at a profit, on account of war conditions. Present owners plan to open the old mine workings and do selective mining. Values are mostly in free gold and can be easily recovered by amalgamation and cyanidation.

**Rochester**—August bullion production by the Rochester Silver Corporation was approximately $45,000, which is normal. The flat vein recently discovered on the 500 level shows promise of a considerable tonnage of mill ore. The crosscut is being continued to cut the Windlass vein.

**Virginia City**—Lateral work from the Hale and Norcross tunnel, which is included in the property now held under option by the Comstock Merger Mines, Inc., is being pushed, and the crew has been increased to seventy-five men. At present six development faces are being advanced; they include north and south foot-wall drifts and four crosscuts. Plans are being made for development of the lode at a lower elevation than the tunnel level.

**Pioche**—Further downward revision in the freight rates on ores has been made by the Union Pacific system, and a number of leasers are expected to resume work. Lack of capital to do necessary development work, however, will prevent a general resumption, it is said.

The Comet district still maintains a small production of lime-base silver ore. The last car from the Stella Lease assayed 48.5 oz. in silver, 2.6 per cent lead and 46.1 per cent insoluble. Another shipment is ready for hauling to the railroad.

Shipments for the week ending Sept. 7 were as follows: Bristol Silver Mines, 735 tons; Prince Consolidated, 710 tons; Mendha mine, 40 tons; Price Lease, 15 tons; total, 1,500 tons.

**Ely**—Increased work at the Exchequer mine in the Cherry Creek district will begin immediately; a new company called the Silver Dividend has been formed by Frank A. Crampton.

Rapid progress is being made with the rebuilding of the Nevada Consolidated mill, at McGill. Two ball mills have now been installed. These mills are the first of a total of thirty. It is expected that ore will be milled beginning next month. The reorganized Consolidated Coppermines Corporation will soon start development work at Kimberley. Three months ago almost every house at Kimberley was nailed up and even the windows boarded, and a trip down Main Street showed a ghost city, but signs of renewed activity are now evident everywhere, and the boarding house and store of the company have both been opened. The large experimental mill will not be operated, and the machinery for the most part will be sold. Robert Marsh, Jr., is in charge.

## UTAH

### Increased Activity in Utah Mining Is Reflected in Business of Utah Power & Light Co.

**Salt Lake City**—The Utah Securities Corporation—organized ten years ago as a holding company to facilitate the consolidation of various small power companies into the Utah Power & Light Co.—has sold to the Electric Bond & Share Co. and Hayden Stone & Co. $2,200,000 par value of Utah Power & Light 7 per cent cumulative first preferred stock. The proceeds from the sale together with funds on hand will be used to pay off $6,952,000 of the Utah Securities 6 per cent gold notes maturing Sept. 16 and the last installment of an original issue of $27,750,000, leaving the company free of floating and funded debt. The business of Utah Power & Light Co. reflects the increased mining activity in the state following the reopening of the copper and lead mines.

Permits to sell mining stock were granted Sept. 13 by the Utah Securities Commission to the following four mining companies: Ophir Silver Mining: Claims in the Ophir mining district, Tooele County—100,000 shares, par value 10c., on a selling cost basis of 25 per cent; Ira Tichenor, president and general manager. The L. Marie Mining Co.: Thirty claims near Grantsville in the Free Coinage district—149,830, at 10c. a share par value, on a commission basis of 2c. a share; John V. Long, president and general manager. The Utah Mammoth Mining Co.: Six claims in the Big Cottonwood district, 100,000 shares, 10c. par value without commission, unless an application for an amendment to permit be made later. The Cottonwood Gold Eagle: Twenty-

two claims in Ferguson Fork, Big Cottonwood district, 200,000 shares at 10c. par value, on a commission of 20 per cent.

**Bingham** — Shipments by Bingham mines (exclusive of the Utah Copper and Utah Consolidated) for the week ended Sept. 2 amounted to 92 cars or about 4,500 tons, compared with 89 cars the week preceding. Shippers were: United States Mining, 47 cars for the week ended Sept. 2, and 45 cars for the week preceding; Utah Apex, 25 and 23 cars; Montana Bingham, 12 and 11; Bingham Mines (Dalton & Lark) 8 and 10 cars. Shipments for the week ended Sept. 8 were: United States Mining, 40 cars; Utah Apex, 24; Montana-Bingham, 6; Bingham Mines, 6; total 88.

**Park City**—The Park Utah is raising its dividend rate from 10c. per share to 15c., so that on Oct. 1 for the third quarter of 1922 it will pay $150,000, which will bring the total thus far to $400,000. The first dividend, 5c. a share, was paid during the Christmas holidays last year. Production is at the rate of 150 to 160 tons daily, and this will be increased with the electrification of the Ontario drain tunnel.

The new ore opened on the 1,260 level in the Judge mine occurs in what is thought to be the southwestern extension of the Black vein so productive in the adjoining Daly West. There is much undeveloped ground to the southwest in the Judge, and the find is of interest both on account of the fact that a good-sized body has already been opened, and because of future possibilities. Park City shipments for the week ended Sept. 8 amount to 3,704 tons compared with 4,336 tons the week preceding. Shippers were: Ontario, 1,090 tons; Park-Utah, 1,058; Silver King Coaltion, 1,001; Judge and Park City Mining and Smelting, 555.

**Eureka** — Tintic shipments for the week ended Sept. 8 totaled 163 cars. Shippers were: Tintic Standard, 42; Chief Consolidated, 37; Grand Central, 17; Colorado, 14; Iron Blossom, 12; Victoria, 7; Eagle & Blue Bell, 7; Dragon, 6; Centennial-Eureka. 4; Gemini, 4; Swansea, 3; Mammoth, 2; Alaska, 2; Tintic Drain Tunnel, 2; American Star, 2; Eureka Hill, 1; Bullion Beck, 1.

**American Fork**—The American Leasing Co., which is operating in Mary Ellen gulch, American Fork canyon, has made its third shipment. The first two shipments are stated to have brought about $2,700 each.

## IDAHO

### Clay Deposits Are Being Investigated

**Moscow**—Hewitt Wilson, ceramist for the U. S. Bureau of Mines, is investigating the clay deposits of this district to determine their applicability to the manufacture of chinaware and other clay products on a commercial scale. The deposits near Joel owned by the Moscow Fire Brick & Clay Products Co. and the Idaho Fire Clay Co.'s property have been examined by Mr. Wilson, as well as the mica deposits near Avon, Idaho.

## MICHIGAN

### Winona Copper Co. Will Unwater No. 2 King Philip Shaft—Copper Range Increases Labor Force

**Houghton**—The decision of the Winona Copper Co. to unwater its No. 2 King Philip shaft and engage in exploratory work in that section of the property is regarded as the forerunner of operations on a more extensive scale. Winona has had more or less of a checkered career, but it has a large area of copper-bearing ground, and No. 2 King Philip shaft holds out promise of good values in the Winona bed. The shaft is 1,100 ft. in depth. There are crosscuts to the lode on the 6th, 8th and 10th levels. The vein where cut is fairly good in mineral content, and the most favorable leads will be followed in exploratory work. Winona is particularly favored in the location of its stamp mill, which adjoins the mine. The water is procured from a storage dam. Transportation charges are eliminated, and this usually is a considerable item in the matter of mine-mill costs.

The labor situation at the mines of the Copper Range Consolidated, which was hard hit during the summer exodus, is showing improvement. For the month of August a net gain of 100 men is reported. This is encouraging, in view of the fact each previous month of the summer season showed a considerable loss in man power. Copper Range is still low in production, its output being approximately 2,000,000 lb. refined.

Three shifts of men are employed on repair work in No. 6 shaft at Quincy, and it probably will be the first of the year before this shaft is again in condition for hoisting rock. The shaft was crushed between the 44th and 52d levels by a series of air blasts, necessitating the straightening and re-timbering of the shaft for the eight levels. The damage is confined to the north side of the shaft, and the south compartment is being used for the men and supplies. Meanwhile, mining operations are proceeding in the bottom levels of No. 6.

## MONTANA

### Davis-Daly Dispute with Anaconda Still Unsettled

**Butte**—The Davis-Daly Copper Co. is shipping upward of 500 tons of ore per day, and arrangements are being made with the East Butte smelter to take 700 tons of ore per day.

Direct operating costs are averaging slightly under 11c. per pound, according to officials. No decision has been reached by the Davis-Daly company and the Anaconda Copper Mining Co. relative to the ownership of the Hesperus vein in the Colorado mine of Davis-Daly. Recently a conference was held in an effort to settle the dispute between the two companies, Davis-Daly claiming that Anaconda has taken out ores from its property and the Anaconda claiming the same against Davis-Daly Co. No agreement was reached, however.

## ALABAMA

### Pig-Iron Production Breaks Record

**Birmingham**—The largest pig-iron production for the year, notwithstanding severe drawbacks and restrictions, was realized in August, the production of twenty-two active stacks being now officially stated at 204,339 tons, compared with 195,000 tons in July.

Wage increases voluntarily made, applying to 50,000 workers, are in effect. They are said to increase the cost of iron making $2.50 to $3 per ton, but the lowest price for pig iron on the Birmingham market being $27.50 per ton, the wisdom of these substantial increases seems evident.

Alabama coal production for the first eight months of the year reached 10,725,000 tons, compared with 8,325,000 tons during the same period of 1921, an approximate increase of about 30 per cent. August production is believed to have established a new high record, stated at 1,750,000 tons. Owing, however, to the recent withdrawal of Western railroad demands, marked by a decline in consumption of 50,000 tons maximum production is probably for the present a thing of the past.

## JOPLIN-MIAMI DISTRICT

### Euterpe Co. Finishes Second Shaft—Red Rose Mill Has Been Moved

**Joplin**—Shaft sinking is to be started at once by the Inter-state Zinc-Lead Co. on its lease near Crestline, Kan. A three-compartment shaft, 4½ x 13 ft., will be put down to a depth of about 170 ft., where the principal ore run lies. No pumping will be necessary before 117 ft., and A. M. Gaines, of Picher, general manager for the company, expects to be able to handle the water from another shaft not far distant, already down. The Red Rose mill, which was purchased at Picher, has been moved to the new site and will be erected at once.

The Moses-Marcum interests are planning to start up the Lucky Jennie and Bunker Hill mines, near Hockerville, after an idleness of about two years. The Lucky Jennie has a concentrator, and machinery has been purchased and is now being moved to the Bunker Hill site, where another mill will be constructed.

The Euterpe Mining Co. has completed the sinking of its second shaft, on its lease north of Hockerville, Okla., across the state line in Kansas. The shaft is 500 ft. south of the mill shaft, and will be connected with it by aerial tram, similar to the one used successfully several years by the Oronogo Mutual Mining Co. Buckets with a capacity of two and one-half tons will be used.

The St. Joseph mine at Picher will be started again soon after an idleness of several weeks. Repairs are being made at the mill and considerable drilling is being done ahead of the operations in the mine. The mine has been a steady producer for several years; about seventeen acres have been cut out on one level.

# THE MARKET REPORT

## Daily Prices of Metals

| Sept. | Copper, N. Y., net refinery* Electrolytic | Tin 99 Per Cent | Tin Straits | Lead N. Y. | Lead St. L. | Zinc St. L. |
|---|---|---|---|---|---|---|
| 14 | 13.75 | 32.00 | 32.25 | 5.95@6.025 | 5.65@5.75 | 6.40@6.45 |
| 15 | 13.75 | 31.875 | 32.125 | 6.00@6.10 | 5.75@5.80 | 6.45@6.55 |
| 16 | 13.75 | 31.875 | 32.125 | 6.00@6.10 | 5.80 | 6.50@6.55 |
| 18 | 13.75 | 31.875 | 32.125 | 6.00@6.15 | 5.85@5.90 | 6.55@6.60 |
| 19 | 13.75 | 31.875 | 32.125 | 6.00@6.20 | 5.85@5.975 | 6.60@6.70 |
| 20 | 13.75 | 32.00 | 32.25 | 6.10@6.25 | 5.90@6.00 | 6.70@6.75 |

*These prices correspond to the following quotations for copper delivered: Sept. 14 to 20 inc., 14c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

## London

| Sept. | Copper Standard Spot | Copper Standard 3 M | Copper Electrolytic | Tin Spot | Tin 3M | Lead Spot | Lead 3M | Zinc Spot | Zinc 3M |
|---|---|---|---|---|---|---|---|---|---|
| 14 | 63⅜ | 63¾ | 71½ | 159½ | 160½ | 24 | 23⅜ | 31⅝ | 30⅞ |
| 15 | 63½ | 63½ | 71½ | 159¼ | 160¼ | 24¼ | 23⅜ | 31⅝ | 30⅞ |
| 18 | 62⅞ | 63⅜ | 71½ | 159 | 160⅛ | 24⅛ | 23½ | 31⅝ | 30⅞ |
| 19 | 62⅝ | 63¼ | 71¼ | 158¾ | 159⅞ | 24 | 23⅝ | 31⅝ | 30⅞ |
| 20 | 62⅝ | 63¼ | 71¼ | 159 | 160¼ | 23⅞ | 23¼ | 31⅝ | 31 |

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

## Silver and Sterling Exchange

| Sept. | Sterling Exchange "Checks" | Silver New York Domestic Origin | Silver New York Foreign Origin | Silver London | Sept. | Sterling Exchange "Checks" | Silver New York Domestic Origin | Silver New York Foreign Origin | Silver London |
|---|---|---|---|---|---|---|---|---|---|
| 14 | 4.41¼ | 99¼ | 68⅞ | 35⅛ | 18 | 4.41 | 99¼ | 69¼ | 35¼ |
| 15 | 4.42 | 99¼ | 69 | 35⅛ | 19 | 4.41½ | 99¼ | 69⅜ | 35⅜ |
| 16 | 4.43 | 99¼ | 69¾ | 35⅜ | 20 | 4.42¾ | 99¼ | 69⅝ | 35⅜ |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

## Metal Markets

### New York, Sept. 20, 1922

Prices have in general shown an advancing tendency during the last week, largely because of the imminence of the new tariff, which is expected to take effect within a day or two. Copper, however, is not affected thereby, and the rise in the price of lead and zinc is due more to short supplies than because of an increased tariff. It is interesting to observe that the price of white arsenic has risen rapidly to 9c. per lb., though the protective tariff on this article has been denied and it is to be continued on the free list.

### Copper

Practically all producers continue to quote 14c. delivered, though the domestic market has been quiet for the last week, particularly on Monday and Tuesday, when the violent decline in the stock market probably had some effect. Consumers are trying to convey the impression that this is a fictitious price and that copper is obtainable at 13.875c., but so far as we are advised this price only obtains where consumers are situated close to refineries, and even then is not general. It is doubtful if a pound of copper has been sold during the week to net producers less than 13.75c. f.o.b. refinery, except for delivery far in the future. The price might be shaded ⅛c. on business extending into the new year.

Export orders, although not large, have been keeping up remarkably well considering the unsettled European situation. Practically all orders have come from England, France, Italy, and Scandinavia. The prices obtained have netted producers slightly more than has been obtained for domestic business.

### Lead

On Thursday, Sept. 14, the American Smelting & Refining Co. increased its official contract price of lead from 5.90 to 6c., New York, and on Tuesday, Sept. 19, made a further advance to 6.10c.

Supplies of lead have again become very scarce, with many producers off the market. Those who are not regular customers of the producers would probably have considerable difficulty in securing lead even at the high end of the range which we quote. Consumptive demand has been fed in recent months in part from stocks, and now that these are down to normal the price is bound to react to such a figure as to bring in additional production. This is already imminent. At least three companies are planning much larger outputs in the next two or three months, and the new tariff may also result in the admission of more Mexican lead than has heretofore been the case, since a flat rate of 2½c. has been levied on bullion and 1½c. on the lead in ores, in distinction to the 25 per cent ad valorem rate heretofore ruling. Consumption may also fall off late in the fall when the automobile storage-battery manufacturers are not likely to be so active, and the cable and paint business may fall away somewhat. Increased business in storage batteries for railway lighting may have an opposite effect.

In short, although there is every indication that lead prices will be very firm during the coming months, and may advance somewhat further in the immediate future, a runaway market is not to be expected.

### Zinc

The market has been strong and active. Prices have risen every day during the week, and the advance shows no indication of stopping. Seven-cent zinc in the near future is freely predicted in the market. Although several factors such as labor shortage, fuel scarcity, and inadequate transportation facilities are keeping production from increasing, a further advance in zinc prices will increase production from some inactive districts in Colorado and elsewhere. It is noteworthy that zinc for future delivery is selling at considerable concessions from the spot and prompt price. One producer was willing to sell spot

today for 6.70c., but would have taken 6.55c. for December-January shipment. High-grade zinc has also increased in price and is now selling for 7.5c. per lb. in excellent volume. The New York price on Prime Western remains at 35c. per 100 lb. above the St. Louis quotation.

### Tin

The tin market has been fairly active at unchanged prices. Warehouse stocks have decreased markedly during the month. Very slight premiums are asked for delivery three months in the future.

Arrivals of tin, in long tons: Sept. 13th, China, 10; Straits, 35; 14th, Liverpool, 25; 18th, Straits, 575; China, 100.

### Gold

Gold in London: Sept. 14th, 93s. 6d.; 15th, 93s. 1d.; 18th, 93s. 4d.; 19th, 93s. 4d.; 20th, 93s. 2d.

### Foreign Exchange

On Tuesday, Sept. 19, francs were 7.6075c.; lire, 4.20c.; marks, 0.0675c.; and Canadian dollars, $\frac{3}{32}$ per cent discount.

### Silver

Silver has improved slightly in price on buying by China, which is reported to be on bear covering account. The improvement in sterling exchange has also added to the firmness in New York. The market closes steady.

**Mexican Dollars.** Sept. 14th, 52⅜; Sept. 15th, 52⅜; Sept. 16th, 53¼; Sept. 18th, 52⅞; Sept. 19th, 53¼; Sept. 20th, 53¼c.

### Other Metals

Quotations cover large wholesale lots unless otherwise specified.

**Aluminum**—Contract prices by principal interest: 99 per cent, 20.1c. per lb.; 98@99, 19.1c.; 94@98, 18c. Odd lots for spot delivery, 98@99 per cent, have been selling as low as 17.75c.

**Antimony — Chinese and Japanese** brands, 7c. W.C.C., 7.25@7.50c. Cookson's "C" grade, 9c. Market firm but not very active owing to lack of offerings from China.

**Bismuth**—$2.20 per lb.

**Cadmium**—Quiet at $1.15 per lb.

**Iridium**—$275@$300. Nominal.

**Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 32@34c. per lb.**

**Palladium**—$55 per oz.

**Platinum**—$118 per oz. Strong.

**Quicksilver**—$67 per 75-lb. flask. Market good. San Francisco wires $63.70.

**Selenium**—$1.80@$1.90 per lb.

**Tellurium**—$1.75 per lb.

**The prices of Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, Thallium, and Tungsten** are unchanged from prices given Sept. 2.

### Metallic Ores

**Chrome Ore**—Indian chrome ore, $18 per ton, c.i.f. Atlantic ports. Rhodesian and New Caledonian, $23 and $25 per ton. Market quiet.

**Manganese Ore**—29c. per long ton unit, seaport.

**Molybdenum Ore**—50@55c. per lb. of $MoS_2$ for 85 per cent $MoS_2$ concentrates.

**Tungsten Ore**—Chinese ore, $6 per long ton unit of $WO_3$. Scheelite reported at $6.25@$6.50. Wolframite, $6@$6.25.

**Iron Ore, Magnetite, Tantalum, Titanium, Uranium, Vanadium, and Zircon** ore are unchanged from the quotations published Sept. 2.

### Zinc and Lead Ore Markets

**Joplin, Mo., Sept. 16**—Zinc blende, per ton, high, $40; basis 60 per cent zinc, premium, $39@$40; Prime Western, $37@$38.50; fines and slimes, $37@$35; average settling price, all grades of blende, $37.62; calamine, basis 40 per cent zinc, $20@$21; average, $20.69.

Lead, high, $84.70; basis 80 per cent lead, $82@$82.50; average settling price, all grades of lead, $80.43 per ton.

In an endeavor to purchase enough ore to give preference in shipments, buyers bid up prices $2 to $3 per ton, but the purchase was only 9,300 tons, sellers asking the higher basis offering from some buyers declining to buy.

A basis of $82 is known to have been offered for lead, and information quite reliable reports an $82.50 basis. The purchase of zinc was an increase of 940 tons, with one agency out of the market for the second week.

Rain last Sunday and cooler weather are assisting production, some mines depending upon surface water having consumed the supply.

**Platteville, Wis., Sept. 17.**—Blende, basis 60 per cent zinc, $40 per ton. Lead, basis 80 per cent lead, $81 per ton. Shipments for the week: Blende, 336; lead, 80 tons. Shipments for the year: Blende, 14,077; lead, 1,284 tons. Shipped during the week to separating plants, 540 tons blende.

### Non-Metallic Minerals

**Feldspar**—No. 1 pottery, $7@$7.50 per gross ton, f.o.b. North Carolina points. Market fair.

**Magnesite**—$15 per ton for crude, $35@$37.50 for calcined magnesite, f.o.b. California points. Northwest American magnesite industry has been shut down for the last year.

**Talc**—200 mesh, $15; 300 mesh, $18.50 per ton, f.o.b. California points.

**Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica,** and **Sulphur** are unchanged from the prices published Sept. 2.

### Mineral Products

**Arsenious Oxide (white arsenic)**—firm at 9c. per lb.

**Copper Sulphate—Large crystals,** 5.85c. per lb.; small, 5.75c.

**Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.**

**Potassium Sulphate and Sodium Sulphate are unchanged from quotations** of Sept. 2.

### Ferro-Alloys

**Ferromanganese** — Domestic, 78@82 per cent, $69@$72 per gross ton, f.o.b., furnace. Spiegeleisen, 19@21 per cent, $39, f.o.b. furnace; 16@19 per cent, $38.

**Ferrosilicon**—50 per cent, $58@$60 per gross ton, f.o.b. works.

**Ferrotungsten**—Domestic, 70@80 per cent W, 65@70c. per lb. of contained W, f.o.b. works.

**Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrotitanium, Ferrouranium, and Ferrovanadium** are unchanged from the prices published Sept. 2.

### Metal Products

**Copper Sheets**—New York base, 21.50c. per lb.; wire, 15.50@15.75c. net.

**Nickel Silver**—29c. per lb., for 18 per cent nickel Grade "A" sheets.

**Yellow Metal**—Dimension sheets, 19.25c.; rods, 16.25c. per lb.

**Zinc Sheets**—Base price, $8 per 100 lb., f.o.b. Illinois points, with discounts for cash and quantity.

**Lead Sheets**—Full lead sheets, 8.75c.; cut lead sheets, 9c. in quantity, mill lots.

### Refractories

**Chrome Brick**—$50 per net ton, f.o.b. shipping point.

**Firebrick**—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio, Illinois, and Kentucky.

**Magnesite Brick**—9-in. straights, $60 per net ton, f.o.b. works.

**Silica Brick**—9-in., per 1,000, $45@$53, f.o.b. shipping points.

**Bauxite Brick, Chrome Cement, Magnesite Cement, and Zirkite** are unchanged from the prices appearing in the issue of Sept. 2.

### The Iron Trade

**Pittsburgh, Sept. 19, 1922**

The steel industry has now worked up to an operation of about 60 per cent of capacity, having got down to a 50 per cent rate at the end of August. The outstanding feature of the steel market situation is the light turnover for late deliveries, say December or the first quarter of the new year. The interest of buyers is almost entirely in early deliveries, for which premiums of approximately $3 to $5 a ton are being paid.

Steel prices are inactive. Galvanized sheets are stiffer, tending to command an additional spread over black sheets. All independent wire mills are now at $2.75 for nails, the Steel Corporation remaining at $2.60. Shipment in a fortnight readily commands the $2.75 price.

**Pig Iron**—Dover furnace is scheduled for resumption, otherwise merchant furnace operations have little promise of increase. The market is stagnant, at about $34 for bessemer, $30 for basic, and $35@$36 for foundry, Valley basis.

**Connellsville Coke**—The market has been $11@$11.50 for furnace and $12.50 @$13 for foundry, but car shortages may effect an advance.

# Current Influences on Copper

## Mining Companies Raising Wages—Tariff Likely to Affect the Red Metal—Export Business Good

By Felix Edgar Wormser
Assistant Editor, *Engineering and Mining Journal-Press*

AN OUTSTANDING development in the copper situation is the disposition shown by many of the leading copper-mining companies to increase the wages of their employees. This movement began in Utah, spread to the Southwest and northern Michigan, and bids fair to take in all the copper-producing districts of the United States before long. Wages have not been raised because of any altruistic motive, but as a direct answer to the shortage of labor, which, so far as the domestic non-ferrous metal-mining industries are concerned, threatened and still threatens to reach serious proportions. Fourteen-cent copper is surely no inducement under present commodity price levels to make an advance in labor's wage. Now that the ball has been started rolling it will be even more difficult to make both ends meet in the copper-mining industry. One of the consequences of the long period of curtailed or entirely abandoned operations is now being reaped. Labor has been driven to other pursuits and is proving hard to attract back to the copper-mining camps. Restrictive immigration laws are another factor.

Although lead and zinc have lately been enjoying a boom, copper has not shared in the general advance. Both lead and zinc surplus stocks are a thing of the past; copper supplies have been reduced greatly, but a shortage of copper is not nearly so imminent as one in lead or zinc. There is much latent production in the copper industry that would quickly appear were the price of copper to advance proportionately to that of the other metals mentioned.

### Monthly Production Figures Easily Estimated

The attitude of many of the copper producers to withhold publication of monthly production statistics has not interfered much with a knowledge of current output. Estimates that will serve all practical purposes are easily made with the aid of such local reports as emanate from the various copper-mining districts of the country. Some criticism of the action of the producers has been voiced here and abroad, and reports have found their way into print to the effect that Anaconda, the "porphyries" and Phelps Dodge were the ring-leaders in the movement. In justice to Anaconda and Phelps Dodge it is only fair to state that the current production of both of these companies is still being made public and is listed in these pages when issued. As illustrating to what lengths producers have gone in this movement, it is noticeable that the Cerro de Pasco Copper Corporation has stopped issuing its valuable production figures. The purpose of the management in this attitude is difficult to fathom, as all the copper which that company and Backus y Johnston produce in Peru is shipped to the United States to be refined and its amount can be quickly determined by consulting the records of imports of the Bureau of Foreign and Domestic Commerce. One British editor remarks that the withholding of production figures must indicate that the statistical position of copper is poor—an exaggeration—but it points out one of the unexpected results of the present feeling of some copper producers about statistical matters.

Current monthly output of smelter copper from mines in the United States and Alaska is estimated to be 86,500,000 lb., compared with 23,500,000 lb. a year ago and a peak monthly production of 160,000,000 lb. in 1916. Imports of copper from Mexico, South America, and elsewhere fluctuate greatly from month to month, but have amounted to 30,000,000 to 50,000,000 lb. in recent months. A large proportion of the metal coming into the United States during the last two months has consisted of refined material. Export business in copper—the barometer of the industry—has been fair, considering the chaotic conditions abroad. According to the records of the Department of Commerce, exports of copper and copper manufactures averaged 60,800,000 lb. monthly for the twelve months which ended with June, 1922. Imports for the same period were 23,000,000 lb. monthly. Germany was by far the largest customer, with a consumption of 230,000,000 lb. in the year to its credit, or more than twice as much as France, which ranked second. Of late German purchases of copper have declined, which is not a healthful augury of export trade conditions, although British and French purchases have been encouraging.

If any industry is likely to be hurt indirectly by the impending high tariff it is the copper industry, regardless of the fact that no tariff has been placed on copper in raw forms. A large potential demand for copper exists abroad, but will be difficult to foster, as payment for foreign purchases of copper cannot be made easily to this country. The United States in its present temper will have no European goods in exchange for its copper or cotton, and payment in gold is out of the question. The American copper industry is able to meet competition in any of the world markets, yet it may become an innocent victim of the present tariff muddle. Germany is reported to be contemplating placing a tariff on copper in retaliation for the American tariff on aluminum.

### American Copper Competes Abroad

Abroad, American copper finds Australian and African metal the most important competitors. The gigantic mining operations of the Katanga company in Africa are yielding an output of close to 9,000,000 lb. per month at a low cost, but high transportation charges to the European market prevent a full realization of the benefits of cheap mining and smelting. Australian copper producers are still hampered by labor troubles, which seemingly have no end on that continent.

The position of copper is much better than it was a year ago, with domestic sales over 100,000,000 lb. per month and exports fair. At 14c., the low-cost producers are at least able to break even or show a slight profit, especially when they are fortunate enough to have a high silver recovery. Undoubtedly it would have been better, in resuming operations, if only the low-cost producers had started mining last spring, but in talking of the welfare of the entire copper-mining industry it is well to remember that there are so many competing units in the habit of steering independent courses, that the benefit of the whole group is seldom placed above that of an individual mining company. Nevertheless, production has not jumped so quickly as it was first thought it would, and the serious difficulty which the copper companies are having in procuring an adequate supply of competent labor will no doubt prevent over-production, with a consequent price depression.

# COMPANY REPORTS

## Utah Copper Co. Reports Profit

Effective April 1, 1921, the mines and properties of Utah Copper Co. were closed down and the production of copper was entirely suspended. Active production was resumed early in April of this year, and a statement of operations for the quarterly period ended June 30, 1922, follows:

The net production of marketable copper after allowing for smelter deductions was 21,332,691 lb. The total quantity of ore milled during the quarter was 1,144,479 dry tons. The average grade of the ore was 1.22 per cent copper, and the average recovery, based on shipments of concentrates to smelter, was 79.51 per cent.

The average cost per net pound of copper produced from concentrates was 11.5c. This cost includes all fixed and general charges, but excludes federal taxes. The gold and silver values in the concentrates are equal to 0.82c. per net pound of copper produced.

Financial results for the quarter are as shown below:

| | |
|---|---|
| Net profit from copper production only | $323,293.81 |
| Miscellaneous income, including payment for precious metals | 380,864.84 |
| Total income for the quarter | $704,158.65 |

Earnings for the second quarter are computed on the basis of 13.015c. per lb. for copper. The quarterly disbursement to stockholders on June 30, 1922, was 50c. per share, amounting to $812,245.

The ore delivery department transported a total of 1,209,713 tons of ore, being an average of 13,294 tons per diem. The Bingham & Garfield R.R. Co., operating in its own common carrier capacity, transported a total of 154,823 tons of freight, or an average of 1,701 tons per diem.

The litigation in which the company was involved with Minerals Separation has been settled out of court to the satisfaction of all concerned, and the company is now a licensee under the patents of Minerals Separation North American Corporation.

## Ray Consolidated Copper Co.

**Copper; Arizona**

The Ray Consolidated Copper Co. resumed active operations in April, 1922, following the complete suspension of production for a period of twelve months, and the usual report of operations, being the forty-fourth quarterly report, covering the second quarter of the year 1922, has been issued. The gross production of copper contained in concentrates for this quarter is as follows:

| | Pounds |
|---|---|
| April | 750,828 |
| May | 2,107,335 |
| June | 2,914,364 |
| Total | 5,772,527 |
| Average monthly production | 1,924,176 |

In addition to copper derived from concentrates, there was a total of 113,044 lb. of copper contained in ore sent direct to the smelter. This, combined with the net smelter returns of copper contained in the concentrates, brings the total net production from both sources for the quarter up to 5,624,243 lb. Milling operations started on April 10, and during the quarter there were milled 245,650 tons, averaging 1.60 per cent copper, an average daily tonnage for the actual operating days of 2,996 tons. The mill recovery for the quarter was 73.43 per cent of the total copper contained in the ore fed. The milling cost for the quarter, including all fixed and general expenses, was $1.38 per ton. The average mining cost of the ore milled for the quarter, including all regular overhead costs, was $1.55 per ton, which includes the usual charge of 15c. per ton for the retirement of prepaid mine development expense. Of this total, 2.7c. was the cost of coarse crushing and loading, leaving a net mining cost of $1.52 per ton.

The average cost per pound of net copper produced for the quarter was 18.03c. This figure includes the customary fixed and general expenses, other than federal income taxes, and also takes into account credit for the value of gold and silver. In addition to regular operating costs, a considerable amount of extraordinary expense was incurred in connection with resumption of operations.

The financial results for the operating period of the quarter are as follows:

| | |
|---|---|
| Operating loss | $312,069.22 |
| Miscellaneous income and gold and silver | 64,201.99 |
| Decrease in surplus for the quarter | $247,867.23 |

The average carrying price of copper for the quarter was 13.026c.

## Chino Copper Co.

**Copper, New Mexico**

A report of the operations of the Chino Copper Co. for the second quarter of the calendar and fiscal year ending June 30, 1922, states that following a complete shutdown of the mines and properties for a period of twelve months, operations were resumed at the mill at Hurley on April 7, with one section and a portion of the regrinding section. The second section was placed in operation on May 7, and the third section on June 6, there being in operation at the close of the quarter three sections and the necessary portion of the regrinding section. At the mines the first shovel was placed in operation on April 10, and by April 19 two more were placed in operation. Additional shovels were manned in May and June, and by June 30 six shovels were working. The gross production of copper contained in concentrates from mill operations, as also the net copper produced for this quarter, after smelter deductions, is shown in the following tabulation:

| | Pounds Gross | Pounds Net |
|---|---|---|
| April | 1,180,016 | 1,140,979 |
| May | 1,730,484 | 1,670,684 |
| June | 3,987,530 | 3,840,511 |
| Totals | 6,898,030 | 6,652,174 |
| Average monthly production | 2,299,343 | 2,217,391 |

The total amount of dry ore treated by the mill for the eighty-six days operated during this quarter was 325,109 tons, or an average of 3,780 tons per operating day, the average content being 1.55 per cent copper. A total of 13,568 dry tons of concentrates as produced, averaging 24.51 per cent copper, equivalent to a recovery of 21.22 lb. per dry ton of ore treated.

The cost per pound of net copper produced from mill operations was 13.70c. This cost includes the regular charges for all items of fixed and general expense, except federal taxes, and the usual credit for precious metal values. Following are the financial results of the company's operations for the period under consideration, based upon an average price of 13.06c. per lb. for copper:

| | |
|---|---|
| Operating loss | $43,222.01 |
| Shutdown and other non-operating expenses | 129,389.12 |
| | $172,611.13 |
| Miscellaneous income, including precious metals | 46,480.16 |
| Decrease in surplus account | $126,130.97 |

The major part of the quarter's deficit is due to shutdown costs and other charges, rather than to operating loss.

# MINING STOCKS

## Week Ended Sept. 16, 1922

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **COPPER** | | | | | | |
| Ahmeek | Boston | 64¾ | 63 | 63¾ | Aug. '22, Q | $1.00 |
| Alaska-Br. Col. new. | N. Y. Curb | 3¼ | 3¼ | 3¼ | ..... | .... |
| Alloues | Boston | 25 | 25 | 25 | Mar. '19 | 1.00 |
| Anaconda | New York | 55¾ | 54 | 54⅜ | Nov. '20, Q | 1.00 |
| Arcadian Consol. | Boston | 3 | 2¾ | 2⅞ | ..... | .... |
| Ariz. Com'l | Boston | 8¾ | 8¼ | 8¼ | Oct. '18, Q | 0.50 |
| Big Ledge | N. Y. Curb | *10 | *8 | *10 | ..... | .... |
| Bingham Mines | Boston | 18⅜ | 17⅜ | 17⅞ | Sept. '19, Q | 0.25 |
| Calumet & Arizona | Boston | .... | .... | 62 | June '22, Q | 0.50 |
| Calumet & Hecla | Boston | 300 | 295 | 296 | Aug. '22, Q | 5.00 |
| Canada Copper | N. Y. Curb | *4 | *1 | *2 | ..... | .... |
| Centennial | Boston | 10 | 9 | 9 | Dec. '18, SA | 1.00 |
| Cerro de Pasco | New York | 40⅜ | 39⅛ | 40⅛ | Mar. '21, Q | 0.50 |
| Chile Copper | New York | 24⅛ | 23⅝ | 24 | ..... | .... |
| Chino | New York | 31¼ | 30¼ | 30½ | Sept. '20, Q | 0.37½ |
| Con. Copper Mines | N. Y. Curb | .... | .... | *25 | ..... | .... |
| Copper Range | Boston | 43⅜ | 39¼ | 40 | Mar. '22, Q | 1.00 |
| Crystal Copper | Boston Curb | 1 1/16 | 1⅛ | 1 1/16 | ..... | .... |
| Davis-Daly | Boston | 5¼ | 4 1/16 | 4⅛ | Mar. '20, Q | 0.25 |
| East Butte | Boston | 10½ | 10¼ | 10¼ | Dec. '19, A | 0.50 |
| First National | Boston Curb | *60 | *55 | *55 | Feb. '19, SA | 0.15 |
| Franklin | Boston | 2⅛ | 2 | 2 | ..... | .... |
| Gadsden Copper | Boston Curb | †*86 | †*81 | *85 | ..... | .... |
| Granby Consol. | New York | 32⅜ | 31⅛ | 32 | May '19, Q | 1.25 |
| Greene-Cananea | New York | 32⅛ | 32⅛ | 32⅛ | Nov. '20, Q | 0.50 |
| Hancock | Boston | 2 | 1⅞ | 2 | ..... | .... |
| Howe Sound | N. Y. Curb | 3¼ | 3⅛ | 3⅛ | Jan. '21, Q | 0.05 |
| Inspiration Consol. | New York | 42 | 41 | 41¼ | Oct. '20, Q | 1.00 |
| Iron Cap | Boston Curb | 7 | 6½ | 6⅝ | Sep. '20, K | 0.25 |
| Isle Royale | Boston | †24 | †21⅛ | 23 | Aug. 22, | 0.50 |
| Kennecott | New York | 37⅜ | 36½ | 36½ | Dec. '20, Q | 0.50 |
| Keweenaw | Boston | 2⅛ | 2 | 2 | ..... | .... |
| Lake Copper | Boston | 4¼ | 3⅞ | 3⅞ | ..... | .... |
| La Salle | Boston | 1⅛ | 1⅛ | 1⅛ | ..... | .... |
| Magma Copper | N. Y. Curb | 34⅜ | 31½ | 34⅜ | Jan. '19, Q | 0.50 |
| Majestic | Boston Curb | †*10 | †*5 | *8 | ..... | .... |
| Mason Valley | N. Y. Curb | 1⅞ | 1⅛ | 1⅝ | ..... | .... |
| Mass. Consolidated | Boston | 2⅞ | 2⅜ | 2⅜ | Nov. '17, Q | 1.00 |
| Miami Copper | New York | 30¼ | 29½ | 29½ | Aug. '22 Q | 0.50 |
| Michigan | Boston | 3⅛ | 2⅞ | 2⅞ | ..... | .... |
| Mohawk | Boston | 61 | 60 | 61 | July '22, Q | 1.00 |
| Mother Lode Coa. | N. Y. Curb | .... | .... | 11 | June '22, I | 0.50 |
| Nevada Consol. | New York | 17 | 16⅛ | 16⅝ | Sept. '20, Q | 0.25 |
| New Cornelia | Boston | 19 | 18⅛ | 18⅝ | Aug. '22, K | 0.25 |
| North Butte | Boston | 12⅛ | 11⅛ | 11⅜ | Oct. '18, Q | 0.25 |
| Ohio Copper | N. Y. Curb | *22 | *15 | *20 | ..... | .... |
| Old Dominion | Boston | 24⅛ | 24 | 24 | Dec. '18, Q | 1.00 |
| Osceola | Boston | 37 | 35 | 36 | Aug. '22, Q | 1.00 |
| Phelps Dodge | Open Mar. | †170 | †160 | ... | July. '22, Q | 1.00 |
| Quincy | Boston | 43 | 42 | 42½ | Mar. '20, Q | 1.00 |
| Ray Consolidated | New York | 16⅜ | 15⅜ | 16 | Dec. '20, Q | 0.25 |
| Ray Hercules | N. Y. Curb | 1⅞ | 1⅜ | 1⅝ | ..... | .... |
| St. Mary's Min. Ld. | Boston | 46⅛ | 44⅛ | 45 | Apr. '22, K | 2.00 |
| Seneca Copper | Boston | .... | .... | 12 | ..... | .... |
| Shannon | Boston | *90 | *80 | *81 | Nov. '17, Q | 0.25 |
| Shattuck Arizona | New York | †9 | †8½ | 9⅛ | Jan. '20, Q | 0.25 |
| South Lake | Boston | *75 | *75 | *75 | ..... | .... |
| Superior & Boston | Boston | 1½ | 1⅜ | 1⅜ | ..... | .... |
| Tenn. C. & C. cfs | New York | 10⅜ | 10 | 10 | May '18, I | 1.00 |
| Tuolumne | Boston | *70 | *62 | *65 | May '13, | 0.10 |
| United Verde Ex. | Boston Curb | 30½ | 28⅜ | 29½ | Aug. '22, Q | 0.25 |
| Utah Consol. | Boston | 3 | 2½ | 2½ | Sept. '18, | 0.25 |
| Utah Copper | New York | 70⅜ | 68⅜ | 69 | June '22, Q | 0.50 |
| Utah Metal & T. | Boston | 1½ | 1½ | 1½ | Dec. '17, | 0.30 |
| Victoria | Boston | †1⅜ | †1⅛ | 1⅜ | ..... | .... |
| Winona | Boston | 1⅞ | 1⅝ | 1⅝ | ..... | .... |
| Wolverine | Boston | 11 | 10 | 10 | ..... | .... |
| **NICKEL-COPPER** | | | | | | |
| Internat. Nickel | New York | 18¼ | 17⅛ | 17⅜ | Mar. '19, | 0.50 |
| Internat. Nickel, pfd | New York | 83½ | 58⅜ | 59½ | Aug. '22, Q | 1.50 |
| **LEAD** | | | | | | |
| National Lead | New York | 108 | 105 | 105 | June '22, Q | 1.50 |
| National Lead, pfd | New York | 115½ | 115½ | 115½ | Sept. '22 Q. | 1.75 |
| St. Joseph Lead | New York | 16 | 15½ | 16 | June '22, Q | 0.25 |
| **QUICKSILVER** | | | | | | |
| New Idria | Boston | *50 | *15 | *40 | ..... | .... |
| **ZINC** | | | | | | |
| Am. Z. L. & S. | New York | 18⅞ | 17 | 18⅛ | May '20, | 1.00 |
| Am. Z. L. & S. pfd. | New York | 47½ | 45⅞ | 47½ | Nov. '20, Q | 1.50 |
| Butte C. & Z. | New York | 7⅛ | 6⅛ | 7 | June '18, | 0.50 |
| Butte & Superior | New York | 31⅜ | 29⅛ | 31⅛ | Sept. '20, | 1.25 |
| Callahan Zn-Ld | New York | 10⅛ | 9⅛ | 9⅛ | Dec. '20, Q | 0.50 |
| New Jersey Zn | N. Y. Curb | 155⅛ | 155 | 155⅛ | Aug. '22, Q | 2.00 |
| Yellow Pine | Los Angeles | *50 | *50 | *50 | Sept. '20, Q | 0.03 |

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Mines and Oil; Colorado Springs, The Financial Press, N. Y.

| Stock | Exch. | High | Low | Last | | Last Div. |
|---|---|---|---|---|---|---|
| **GOLD** | | | | | | |
| Alaska Gold | New York | ⅛ | 1/16 | ⅛ | ..... | .... |
| Alaska Juneau | New York | 1⅛ | 1⅛ | 1⅛ | ..... | .... |
| Atlas | Toronto | *40 | *29 | *39½ | ..... | .... |
| Carson Hill | Boston | 9¼ | 8⅞ | 9 | ..... | .... |
| Cresson Consol. G. | N. Y. Curb | 2⅜ | 2⅛ | 2 11/16 | July '22, Q, X | $0.10 |
| Dome Mines | New York | 39¼ | 38⅜ | 39 | July '22, Q | .50 |
| Florence Goldfield | N. Y. Curb | *21 | *19 | *20 | ..... | .... |
| Golden Cycle | Colo. Springs | *92½ | *88 | *88 | June '21, Q | 0.02 |
| Goldfield Consol. | N. Y. Curb | *7 | *7 | *7 | Dec. '19, | 0.05 |
| Hollinger Consol. | Toronto | 14.20 | 13.45 | 13.70 | Sept. '22, | 0.05 |
| Homestake Mining | New York | 74¼ | 72½ | 73 | Aug. '22, M | 0.25 |
| Keora | Toronto | *13 | *10½ | *12 | ..... | .... |
| Kirkland Lake | Toronto | *47 | *45 | *46½ | ..... | .... |
| Lake Shore | Toronto | 3.05 | 2.88 | 2.90 | Aug. '22, Q | 0.02 |
| McIntyre-Porcupine | Toronto | 19.80 | 18.10 | 18.90 | Sept. '22, K | 0.25 |
| Porcupine Crown | Toronto | *27 | *23 | *25 | July '17, | 0.03 |
| Portland | Colo. Springs | *40 | *40 | *40 | Oct. '20, Q | 0.01 |
| Schumacher | Toronto | *58 | *57½ | *58 | ..... | .... |
| Silver Pick | N. Y. Curb | *8 | *8 | *8 | ..... | .... |
| Teck Hughes | Toronto | *96 | *86 | *93 | ..... | .... |
| Tom Reed | Los Angeles | *65 | *60 | *65 | Dec. '19, | 0.02 |
| United Eastern | N. Y. Curb | 1⅜ | 1 1/16 | 1⅜ | July '22, Q | 0.15 |
| Vindicator Consol. | Colo. Springs | †*5 | †*4 | *4 | Jan. '20, Q | 0.01 |
| Vipond Cons. | Toronto | *75 | *66 | *68 | ..... | .... |
| White Caps Mining | N. Y. Curb | *13 | *13 | *13 | ..... | .... |
| Wright-Hargreaves | Toronto | 3.40 | 3.15 | 3.30 | July '22, | 0.02½ |
| Yukon Gold | N. Y. Curb | *98 | *90 | *98 | June '18, | 0.02½ |
| **SILVER** | | | | | | |
| Batopilas Mining | New York | ⅛ | ⅛ | ⅛ | Dec. '07, I | 0.12½ |
| Beaver Consol. | Toronto | *40 | *33 | *37 | May '20, K | 0.03 |
| Coniagas | Toronto | 1.75 | 1.40 | 1.75 | May '21, Q | 0.12½ |
| Crown Reserve | Toronto | *26½ | *24 | *25 | Jan. '17, | 0.05 |
| Kerr Lake | N. Y. Curb | 3⅛ | 3⅛ | 3⅛ | July '22, Q | 0.12½ |
| La Rose | Toronto | *29¼ | *28½ | *29¼ | Apr. '22, | 0.10 |
| McKinley-Dar.-Sav. | Toronto | *31 | *28½ | *29 | Oct. '20, Q | 0.03 |
| Mining Corp. Can. | Toronto | .... | .... | *90 | Sept. '20, Q | 0.12½ |
| Nipissing | N. Y. Curb | 6⅜ | 6⅛ | 6⅛ | July '22, Q, X | 0.30 |
| Ontario Silver | New York | 7 | 6⅜ | 6⅜ | Jan. '19, Q | 0.50 |
| Ophir Silver | N. Y. Curb | .... | .... | *12 | Jan. '12, | 0.10 |
| Temiskaming | Toronto | *40½ | *33 | *37 | Jan. '20, K | 0.04 |
| Trethewey | Toronto | *6 | *5 | *5½ | Jan. '19, | 0.05 |
| **GOLD AND SILVER** | | | | | | |
| Boston & Montana | N. Y. Curb | *14 | *10 | *10 | ..... | .... |
| Cash Boy | N. Y. Curb | *10 | *10 | *10 | ..... | .... |
| Dolores Esperanza | N. Y. Curb | 2½ | 2 | 2⅛ | July '22, | 2.50 |
| El Salvador | N. Y. Curb | *17 | *12 | *12 | ..... | .... |
| Jim Butler | N. Y. Curb | .... | .... | *6 | Aug. '18, SA | 0.07 |
| Jumbo Extension | N. Y. Curb | *8 | *8 | *8 | June '16, | 0.05 |
| MacNamara M.&M. | N. Y. Curb | *13 | *6 | *10 | May '10, | 0.02½ |
| Tonopah Belmont | N. Y. Curb | 1⅞ | 1⅜ | 1⅜ | July '22, Q | 0.05 |
| Tonopah Divide | N. Y. Curb | *89 | *80 | *85 | ..... | .... |
| Tonopah Extension | N. Y. Curb | 2⅛ | 2⅛ | 2⅛ | July '22, Q | 0.05 |
| Tonopah Mining | N. Y. Curb | 2⅛ | 2⅛ | 2 1/16 | Apr. '22, SA, X | 0.07½ |
| West End Consol. | N. Y. Curb | 1 1/16 | 1⅛ | 1⅛ | June '22, SA | 0.05 |
| **SILVER-LEAD** | | | | | | |
| Caledonia | N. Y. Curb | .... | .... | *8 | Jan. '21, M | 0.01 |
| Cardiff M. & M. | Salt Lake | *65 | *65 | *65 | Dec. '20, | 0.15 |
| Chief Consol. | Boston Curb | 6 | 5⅜ | 6 | Aug. '22, Q | 0.10 |
| Columbus Rexall | Salt Lake | †*25 | †*20 | *23 | Aug. '22, | 0.03 |
| Consol. M. & S. | Montreal | 27 | 27 | 27 | Oct. '20, Q | 0.62½ |
| Daly Mining | Salt Lake | .... | †1.30 | .... | July '20, Q | 0.10 |
| Eagle & Blue Bell | Boston Curb | †*4½ | †*3½ | *3½ | Apr. '21, K | 0.05 |
| Electric Point | Spokane | *2½ | *2 | *2½ | May '20, SA | 0.03 |
| Federal M. & S. | New York | †15⅜ | †12½ | 15½ | Jan. '09, | 1.50 |
| Federal M. & S. pfd. | New York | 61½ | 58⅜ | 60½ | Sept. '22, Q | 1.25 |
| Florence Silver | Spokane | *33 | *32½ | *32½ | Apr. '19, | 0.01½ |
| Grand Central | Salt Lake | †*65 | †*60 | *61 | Jan. '21, K | 0.01 |
| Hecla Mining | N. Y. Curb | 7⅜ | 7⅛ | 7⅛ | June '22, Q | 0.15 |
| Iron Blossom Con. | N. Y. Curb | .... | .... | *29 | Apr. '22, Q | 0.02½ |
| Judge M. & S. | Salt Lake | †3.60 | †3.00 | 3.40 | Sept. '20, Q | 0.12½ |
| Marsh Mines | N. Y. Curb | *15 | *11 | *15 | June '21, I | 0.02 |
| Prince Consol. | Salt Lake | *9⅜ | *9 | *9½ | Nov. '17, | 0.02½ |
| Rambler-Cariboo | Spokane | *5 | *2½ | *5 | Feb. '19, | 0.01 |
| Rex Consol. | N. Y. Curb | *10 | *9 | *10 | ..... | .... |
| Standard Silver-Ld. | N. Y. Curb | *19 | *19 | *19 | Oct. '17, | 0.05 |
| Stewart Mines | N. Y. Curb | *8 | *7 | *7 | Dec. '15, | 0.05 |
| Tamarack-Custer | Spokane | 3.20 | 3.15 | 3.15 | Jan. '21, K | 0.04 |
| Tintic Standard | Salt Lake | 2.10 | 1.95 | 2.10 | Dec. '21, Q | 0.05 |
| Utah Apex | Boston | 3 | 2⅞ | 2⅞ | Nov. '20, K | 0.25 |
| Wilbert Mining | N. Y. Curb | .... | .... | *5 | Nov. '17, | 0.01 |
| **VANADIUM** | | | | | | |
| Vanadium Corp. | New York | 53 | 51 | 51⅛ | Jan. '21, Q | 1.00 |
| **ASBESTOS** | | | | | | |
| Asbestos Corp. | Montreal | 70 | 67 | 70 | July '22, Q | 1.50 |
| Asbestos Corp. pfd. | Montreal | 85 | 84 | 85 | July '22, Q | 1.75 |
| **SULPHUR** | | | | | | |
| Freeport Texas | New York | 25¼ | 23 | 24 | Nov. '19, Q | 1.00 |
| Texas Gulf | New York | 57 | 50⅛ | 56¾ | Sept. '22, QX | 1.00 |
| **MINING, SMELTING AND REFINING** | | | | | | |
| Amer. Sm. & Ref. | New York | 65⅛ | 63⅛ | 64 | Mar. '21, Q | 1.00 |
| Amer. Sm.& Ref. pf. | New York | 103⅛ | 102⅛ | 103¼ | Sept. '22 Q | 1.75 |
| Am. Sm. Sec. pf. A. | New York | 97 | 97 | 97 | July '22, Q | 1.50 |
| U. S. Sm. R. & M. | New York | 43⅛ | 42⅛ | 43 | Jan. '21, Q | 0.50 |
| U.S. Sm.R.& M. pf. | New York | 48⅛ | 48⅛ | 48⅛ | July '22, Q | .87½ |

# INDUSTRIAL NOTES

## Grand Central Palace Reclaims Chemical Show

### Exhibitors Number Almost Four Hundred—Technical Sessions Include Variety of Papers — Moving Pictures Draw Good Attendance

WHILE many of the exhibits shown at the Eighth National Exposition of the Chemical Industries during the week of Sept. 11 were a repetition of those displayed in past years, a number of recent applications of the older machines, as well as several new products, were in evidence.

The booths which were taken by about 400 exhibitors occupied four floors of the Grand Central Palace, whereas last year the exhibition was staged at the Eighth Coast Armory. The mechanical sessions were held on the fourth floor, where also were shown the moving pictures. Throughout the entire week the attendance was excellent.

The papers presented included a miscellany of topics, ranging from the attitude of the Anti-Saloon League toward industrial alcohol to synthetic perfumes and including the mechanics of motion-picture apparatus and principles of radiotelephony. A full report of the technical meetings and exhibits will be presented in the Sept. 27, or report issue, of *Chemical and Metallurgical Engineering*.

The moving pictures claimed considerable attention from the mining men present, although many of the views shown have already been exhibited at meetings of the A.I.M.E. and elsewhere. The activities of the Bureau of Mines in conjunction with different manufacturers in motion-picture work are particularly commendable, although there were a number of those prepared by various private companies that were favorably commented upon. Among the pictures shown were "The Story of Sulphur," "Dust Explosions," "The Story of Asbestos," "Nickel and Copper Mining," "Smelting and Refining," "Recovering Values from Fume and Smoke," "Prospecting for Gold in Northern Ontario," "Assaying in Northern Ontario," "Mexican Petroleum," and "Inspiration: One of the World's Great Copper Mines."

It is impossible in the space available to detail the various exhibits shown, but a number of those interesting to the mining fraternity will be mentioned briefly, although others were equally attractive:

**Anaconda Copper Mining Co., New York City.**—This company occupied one of the largest booths together with **American Brass Co., Waterbury, Conn.; International Smelting Co., Perth Amboy, N. J.; Raritan Copper Works, Perth Amboy**; and **United Metals Selling Co., New York City.** The exhibits shown could well be labelled "From Ore to Finished Product," for ore, chemicals, and completed articles were placed in an attractive display. Probably the most novel of the last mentioned and the one which drew the most attention was the copper shingle exhibit.

**Allis-Chalmers Manufacturing Co., Milwaukee, Wis.,** displayed centrifugal and vacuum pumps, motors, and crushers.

**American Cyanamid Co., New York City,** showed an attractive cabinet display of chemicals made from air, including their well-established "Aero Brand" of cyanide.

**American Smelting & Refining Co., New York City,** as represented by its subsidiary, the **Baltimore Copper Smelting & Rolling Co., Baltimore, Md.,** displayed a variety of copper products and chemicals.

The exhibit of the **Abbe Engineering Co., New York City,** included a number of grinding mills for plant and laboratory use.

**Baker & Co., Inc., Newark, N. J.,** had an excellent exhibit of platinum, silver, and gold containers for laboratory and refinery use.

Coal-tar products constituted the essential part of the exhibit of the **Barrett Co., New York City.**

**Bethlehem Foundry & Machinery Co.,** controlling the **Wedge Mechanical Furnace Works, Philadelphia, Pa.,** showed the familiar model of the Wedge roasting furnace which has remained the standard roaster of concentrates for reverberatory furnaces.

**The Bristol Co., Waterbury, Conn.,** showed a very complete line of electrical temperature and pressure-control instruments.

**British America Nickel Co., New York City,** showed electrolytic nickel, specimens of ore and a number of nickel articles produced by a special method of electrolytic deposition.

An unusual and attractive booth was that of the **Cleveland-Cliffs Iron Co., Cleveland, Ohio,** consisting of silver birch logs which formed the background, railings, and entrance of the exhibit. This company makes excellent flotation oils, which are in considerable demand in the mining field.

**Crane Co., Chicago, Ill.,** exhibited traps for boilers, and a full line of valves and fittings.

The feature of the **Dings Magnetic Separator Co., Milwaukee, Wis.,** exhibit was a large magnetic pulley on which were retained a number of iron and steel tools.

The familiar models of the classifier, bowl classifier, thickener, tray thickener, and agitator made by the **Dorr Co., New York City,** attracted a great deal of attention. This company has developed considerable use for its equipment in fields other than mining.

**Eimer & Amend, New York City,** displayed a complete line of balances, microscopes, reagents, filter papers, and other laboratory appurtenances.

The exhibit of the **General Electric Co., Schenectady, N. Y.,** included electric arc-welding machines, wattmeters, voltmeters, and other laboratory instruments.

**Hardinge Co., New York City,** occupied a booth with the **Ruggles-Coles Engineering Co.** The former was represented by the Hardinge mill; the latter showed a model of the familiar Ruggles-Coles drier.

**Illinois Zinc Co., New York City,** made a special feature of zinc shingles, in addition to a good showing of other zinc products.

**International Nickel Co., New York City,** showed a number of articles made from nickel, including a washing machine. Considerable space was given to the featuring of "Monel" metal.

Considering the array of shingles which was noticeable at other booths, it was not surprising to find asbestos shingles on display at the exhibit of **Johns-Manville, Inc., New York City.** In addition, a number of other asbestos products were shown.

**Leeds & Northrup Co., Philadelphia, Pa.,** showed pyrometers and other recording and controlling apparatus.

Valves, lubricators, water columns and whistles constituted the main part of the exhibit of the **Lunkenheimer Co., Cincinnati, Ohio.**

**Mine Safety Appliances Co., Pittsburgh, Pa.,** showed a great variety of safety equipment, including mine rescue and fire-fighting apparatus, goggles, and first-aid equipment.

A silent chain drive in operation was the feature of the **Morse Chain Co., Ithaca, N. Y.**

**Newark Wire Cloth Co., Newark, N. J.,** exhibited samples of mesh screening in copper and other metals.

Acid pumps, centrifugal pumps, and continuous-filtration machines were shown by the **Oliver Continuous Filter Co., San Francisco, Calif.**

**Philadelphia Gear Co., Philadelphia, Pa.,** had a small-sized herringbone gear in operation as the principal attraction of its exhibit.

**Power Specialty Co., New York City,** exhibited Foster superheaters, oil heaters, and the Foster economizer.

**The New Jersey Zinc Co., New York City,** showed, by means of a model flow sheet in which actual objects represented the various products, the development of its resources from the zinc ores to the finished products. Zinc roofing and castings and spun zinc were also shown.

**Research Corporation, New York City,** showed a model of the Cottrell electrical precipitation apparatus for removing mineral from smoke fumes or dust.

**Roessler & Hasslacher Chemical Co., New York City,** exhibited an extensive line of chemicals.

**Sandvik Steel, Inc., New York City,** attracted considerable attention with a small operating model of a steel belt conveyor.

**Texas Gulf Sulphur Co., New York City,** showed a number of samples of sulphur. The exhibit also included diagrammatic drawings showing the Frasch process by means of which the sulphur is obtained from the Texas deposits of this company.

**W. S. Tyler Co., Cleveland, Ohio,** showed a number of woven wire screens. A "Hum-mer" electric screen and its "Ro-Tap" testing sieve shaker were in operation.

A continuous filter, filter press, and leaves were shown in the exhibit of the **United Filters Corporation, New York City.**

**U. S. Bureau of Mines, Washington, D. C.,** had on exhibition at its booth rescue apparatus and equipment, resuscitating devices, safety lamps and a number of its publications pertaining to industrial research and safety.

**B. F. Sturtevant Co., Hyde Park, Mass.,** exhibited driers suitable for use in the chemical industries. This company also makes a complete line of blower and ventilating fans.

**Sturtevant Mill Co., Boston, Mass.,** showed crushing, grinding, screening, mixing, elevating, and conveying machinery.

The exhibit of **Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.,** consisted principally of electric furnaces and safety switches.

**Zinsser & Co., Hastings-on-Hudson, N. Y.,** exhibited an attractive showing of dyes. This company also manufactures "Aczol," a wood preservative which should have a large application in the mining field.

A number of the chemical societies were represented, as were also several periodicals and companies which publish technical books.

Exhibits of metallic and non-metallic ores, in addition to those mentioned, included those of the Ontario Department of Mines, Toronto, Ontario, Canada, and the Southern Railway, System Division Service, Washington, D. C.

## A Handbook for Belt Users

Under the title, "Short Cuts to Power Transmission," the Flexible Steel Lacing Co., 4,607 Lexington St., Chicago, Ill., has issued a convenient manual for belt users. In the preparation of the text the compilers have endeavored to eliminate the exhaustive technical formulae common to belting problems. The most important phases of practical belting practices are incorporated in simplified form. The information regarding lacings has been carefully prepared, the object being to simplify old practices with proven modern methods.

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The Hercules Powder Co. has announced a reduction in its selling prices of high explosives and "B" blasting powder, effective Sept. 18.

## New Electric Power Handbook

The Electric Power Club, Kirby Building, Cleveland, Ohio, has issued a new edition (the fourteenth) of its handbook covering substantially all the standardization it has effected in the electric motors, motor pulleys, generators, transformers, electric tools, mining and industrial locomotives, control equipment, power switchboards and switching equipment manufactured in this country.

The handbook also contains definitions, symbols, general engineering, recommendations and other information needed by users and purchasers of electric-power apparatus and control equipment.

Single copies will be given, without charge, to consulting engineers, architects, electric light and power companies, rated electrical contractors and educators—otherwise the charge is 50c. per copy.

## Thermit Welding Instructions

A handbook which will be of considerable service in the mine, mill, or smelter shop where thermit welding is done has been issued by the Metal & Thermit Corporation, 120 Broadway, New York City. This contains instructions for the use of thermit welding in shops and outlines the correct procedure that should be followed. A number of practical "don'ts" are given, together with necessary tables and other valuable information.

## TRADE CATALOGS

**Tube Mills**—Krupp patent tube mills with continuous feed and discharge for dry grinding all materials are described in circular G 3. Thomas Prosser & Son, 15 Gold St., New York City, are the American representatives.

**Ball Mills**—Fried. Krupp a.-g. Grusonwerk, Magdeberg-Buckau, crushing department, have issued list I. 12., which illustrates and describes Krupp ball mills for continuous crushing and discharging. A table of dimensions, power required and weights is included. Thomas Prosser & Son, 15 Gold St., New York City, are the American representatives.

**Drills**—Sanderson-Cyclone Drill Co., Orrville, Ohio, has issued catalog B-45, "Big Blast Hole Drills." This is a well-illustrated book of ninety-six pages which covers in a complete manner the application of "Cyclone" drills to quarry, open-pit mining, and heavy rock excavation. Equipment lists, operating and cost data and other valuable information included. The book is an excellent example of a well-planned trade catalog.

**Drills**—General catalog No. A-70, issued by the Sanderson-Cyclone Drill Co., Orrville, Ohio, fully illustrates and describes "Cyclone" drills and tools, and discusses the several systems of deep-hole drilling and the kinds of work for which they are best adapted. The treatment of this issue is in keeping with the high standards of informative service which seems to be the aim of the Sanderson-Cyclone company.

**Flexible Joints**—W. H. Dorman & Co., Ltd., Stafford, England, have issued a twenty-six-page booklet illustrating and describing "Flexstel" expansible and flexible joints. These joints are of steel and other metals, from ¼ in. to 12 in. bore, and are said to withstand successfully the highest fluctuating and intermittent pressures for water, gas, oil, air, acids, and saturated or superheated steam.

**Rock-Crushing Equipment**—The Austin Manufacturing Co., Chicago, Ill., has issued catalog No. 29, which illustrates and details Austin rock-crushing equipment. Gyratory crushers, elevators, screens, bins and dump cars are shown, together with illustrations of the machines and drawings of a number of crushing plants.

**Pole Heads**—The R. D. Nuttall Co., Pittsburgh, Pa., has issued folder No. 33, which illustrates and describes the Nuttall "Electricsteel" pole head for use on trolley locomotives. A number of new features are incorporated in this device.

**Centrifugal Pumps**—The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has issued leaflet No. 2060, entitled "Solid Bronze Centrifugal Mine Pumps," which announces the development of special single and multi-stage bronze pumps, particularly designed to resist the acidulous and erosive action of mine water.

**Pyrometers**—The Bristol Co., Waterbury, Conn. has just issued catalog No. 1401, "Bristol's Pyrometers." This issue shows a complete line of high- and low-resistance pyrometers which operate on the thermo-electric principle. Both indicating and continuous recorder types are shown. Round and strip charts, multiple switch attachments, leads, fire-ends, protection cases, protection wells, and other fixtures, together with application and installation sketches, are shown. The book is well illustrated with cuts showing the instruments and their installation.

**Swing Hammer Pulverizers**—The Jeffrey Manufacturing Co., Columbus, Ohio, has issued catalog No. 368, "Jeffrey Swing Hammer Pulverizers." This catalog contains forty-two pages of descriptive information, together with numerous shop illustrations and installation views showing the application of these pulverizers, which are built in the following types: Type A for general purposes; type B for breakdown machines and fine grinding, and type D for fine-grinding of limestone and similar rock.